Toward Sustainable EU Cities

Zoeteman, Bastiaan; Mulder, Rens; Smeets, Ruben; Wentink, Corné

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A quantitative benchmark study of 114 European and 31 Dutch cities

Prepared for the Dutch Presidency of the EU 2016

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Project team

Prof. Kees (Bastiaan) Zoeteman
Rens Mulder, BSc
Ruben Smeets, MSc
Corné Wentink, MSc

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Warandelaan 2
5037 AB Tilburg
Postbus 90153
5000 LE Tilburg

T 013 - 466 87 12
telos@uvt.nl
www.telos.nl

telos brabants centrum voor duurzame ontwikkeling

TSC Tilburg Sustainability Center

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Summary

The sustainability scores for 114 EU cities were found to vary widely, while variations for the Dutch cities studied were relatively small. Based on these findings, cities can identify their stronger and weaker points and subsequently analyze whether and how these can and should be improved through, for example, local or regional policy initiatives. Population size, demographic dynamics, geographical region, typology and competitiveness (e.g. "disposable income" and "labor productivity") were found to be important determinants of urban sustainability performance. An advanced European Knowledge and Exchange Program on Improving Urban Sustainability, in the framework of the Urban Agenda, and building on URBACT, for example, could help to improve the present database and better address regionally differentiated urban sustainability challenges.

A report for the Dutch EU Presidency

This report presents the results of an integrated sustainability assessment of 114 EU cities and 31 Dutch municipalities with a population of more than 100,000. The study was carried out by Telos, an academic center for local and regional sustainability studies at Tilburg University, the Netherlands. With the support of the Dutch Ministry of Interior and Kingdom Relations, Telos has taken this initiative to reveal the sustainability challenges that may arise in the cities studied and possible ways to address them. The intention is to present the outcome of the benchmark study during the Dutch Presidency of the EU in the first half of 2016. In addition to this report, the project has established an interactive website (www.sustainablecitiesbenchmark.eu) on which representatives of the cities involved can benchmark their city from different points of view in relation to other cities. In this way, cities can learn from each other as well as identify the necessary impetus that regional, national or EU authorities might be able to provide, and thereby design the most appropriate policy strategy for their municipality or region.

Broad definition of sustainability used for benchmarking

In this study, "sustainable development" is defined in a broad sense, to include not only ecological but also social and economic characteristics. It is the first

benchmark study of its kind with respect to the broad number of aspects and indicators (86), as well as the number of EU cities involved. The methodology to assess sustainability performance has been developed by Telos since 2000 and resembles the European Reference Framework for Sustainability of Cities (RFSC) developed at a later date. One major difference with the RFSC is that in this study general sustainability requirements have been quantified and data for the cities studied have been compiled and assessed. The assessment resulted in sustainability scores for all indicators, which measured three forms of "sustainability capital" – economic, ecological and sociocultural – divided into a number of "stocks" and expressed as a percentage achievement (0-100%) of sustainability "requirements" (these terms are defined below).

Sustainability scores of EU cities vary widely, while variations for Dutch cities remain small

The total sustainability scores of the cities studied varied considerably, ranging from 35% to 65%. The highest scoring cities, with total sustainability scores above 60%, were mainly Scandinavian and German, such as Espoo, Stockholm and Munich. The lowest scoring cities, with total scores below 40%, included Naples, Thessaloniki and Constanta.

On average, the Dutch cities studied scored higher than the group of 114 EU cities. The differences in scores between the Dutch cities were also rather small, ranging from 53.4% to 59.6%. In a comparison with a selection of 20 EU cities of the same size and regional position around the North Sea Basin, it was found that three cities outperformed the best-scoring Dutch city: Linköping, Umeå and Nuremberg. Several UK cities scored at the lower end of this group, while Amsterdam scored somewhat lower than Frankfurt, and Antwerp and Rotterdam had almost the same scores.

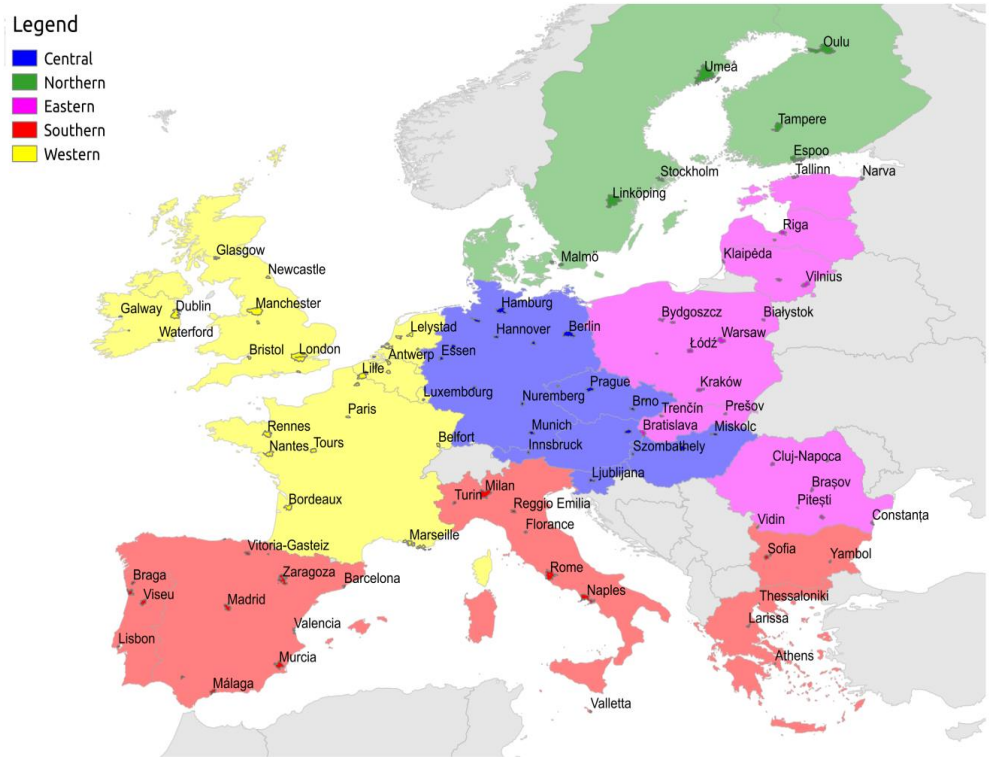
Using the outcome of the studies, cities can identify their stronger and weaker points and subsequently determine whether and how these can be improved, through, for example, local or regional policy initiatives. Not all lower-scoring stocks may be changeable. Using the outcomes as a checklist of issues for potential sustainability improvements, authorities can select those which can be improved and have the highest political priority from a local or regional point of view.

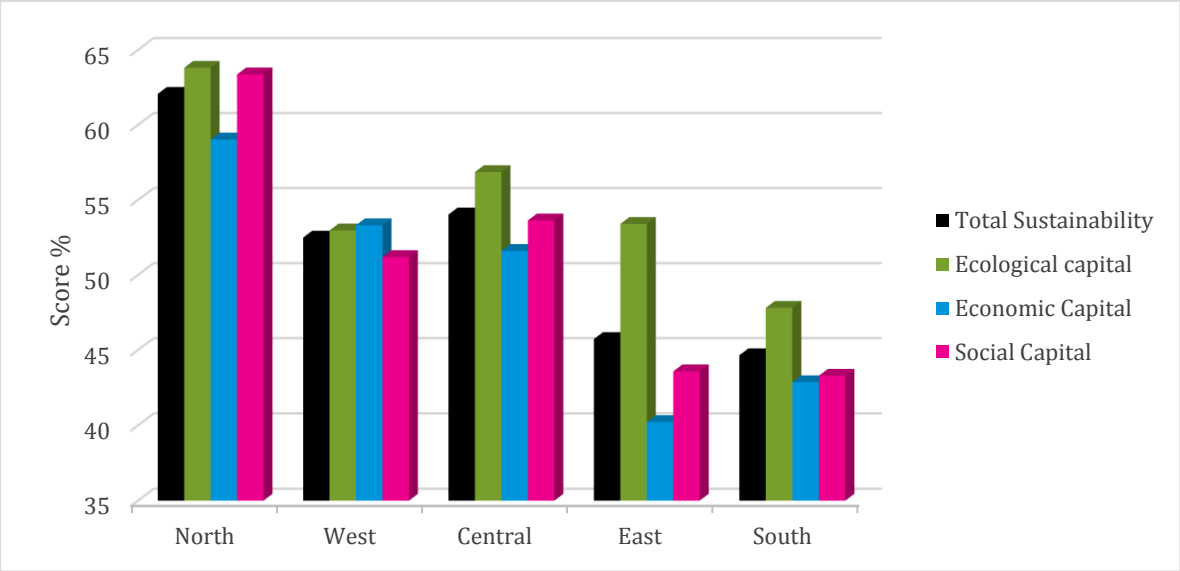
Population size, demographic dynamics, geographical region, typology and competitiveness are important determinants of sustainability

The overall sustainability scores of EU cities improve for larger population numbers, up to cities of two million inhabitants. This is the result of rising economic capital scores as a city increases in size. However, for cities above 250,000 inhabitants, this is accompanied by diminishing ecological and social capital scores. Thus, from a sustainability point of view, a city size of 100,000-250,000 inhabitants seems to be attractive. Moreover, at a size of two million

inhabitants or more it shows that further growth no longer results in improved economic capital performance, while a reduction in the scores for social and ecological capital continues.

Shrinking and growing cities hold quite different positions from a sustainability point of view. The more a city grows, the better its sustainability performance.





Geographic location is a dominant factor in understanding and predicting urban sustainability performance. The Scandinavian cities shine at the top of the lists, while cities in southeast Europe are confronted with major challenges to improve sustainability performance, both economically and socially.

City typology also turns out to be an important instrument in understanding urban sustainability dynamics. Wealthy and green cities perform better than the overall average and compact cities less than average, while harbor cities and agricultural cities do not deviate significantly from the average scores for sustainability. City typology is a key instrument in benchmarking cities in a fair and constructive way.

The concept of sustainable development presupposes that the three kinds of sustainability capital (ecological, sociocultural and economic) and their constituting stocks and indicators are interrelated. The present study reveals which stocks and indicators are most frequently significantly correlated. The stocks of “competitiveness,” “knowledge,” “resources and waste handling,” “infrastructure and mobility” and “health” are particularly important in this respect. Further analysis is needed to better understand the association of these stocks with total sustainability performance and, thereby, to clarify which stocks and indicators are the primary drivers of improved sustainability and how municipal, regional, national or European government policies can influence them. Within the competitiveness stock, “disposable income” and “labor productivity” are particularly important reference indicators of broader sustainability.

Future research agenda for improving urban sustainability in all regions of the EU

The outcomes of this study encourage the development of a knowledge-generating program that can help to address the major urban sustainability

challenges stipulated in the Urban Agenda. One main challenge for the Urban Agenda is to find answers to and action perspectives on the following issues (among others):

1. How sustainable is the growth of cities which currently have high levels of wealth but are confronted with an aging population?
2. How can different types of shrinking cities be made sustainable in the longer term?
3. Which urban zones are of decisive importance for improving the sustainability performance of the EU and how important are their interlinkages and the spinoffs in their regions for sustainable development in the EU?
4. How can smaller cities and towns be included in the EU databases and policy instruments?
5. How can sustainability perspectives of smaller cities in Europe – in which the largest part of the EU population lives – be improved in the longer term without negatively impacting their ecological and social quality?

These questions form the basis of an important urban sustainability research agenda. The development of an explanatory model of sustainability performance could help us find answers to such questions. It is recommended that such a European Knowledge Program on Improving Urban Sustainability in the framework of the Urban Agenda, and building on URBACT and other EU initiatives, be created.

Furthermore, this study has identified that a number of improvements to data collection and handling are required, such as:

1. Expanding the number of European cities included in the Urban Audit Perception Survey from the present 79 to at least 250, covering cities of different size and all regions of the EU;
2. Better monitoring of the present migration crisis;
3. Collection and sharing of data related to economic indicators, not only at NUTS 2 or higher aggregation levels but also at city level;
4. Organizing concrete and realistic feedback on the results of actual EU and national policies on CO2 emissions reduction that not only fulfils requirements of the UNFCCC but also supports action at the municipal level;
5. Collection of more specific municipal data, for example, on the state of technological advances regarding energy transition (energy consumption by households, wind power, solar power, etc.), the transition to a circular economy, the availability of sustainable business areas, etc.

1 Introduction

1.1 Study background

The Netherlands, responsible for the EU Presidency in the first half of 2016, has chosen the strengthening of opportunities and innovation in the urban environment as one of the issues it wishes to promote. The Dutch Minister of the Interior and Kingdom Relations, Ronald Plasterk, took the initiative in this field, together with his colleagues in Infrastructure and Environment and in Economic Affairs, to establish the "Urban Agenda for Better Regulation and Innovation" project. One of its stipulated goals was to stimulate innovation in housing, employment and transport to make cities and towns more sustainable and improve citizen participation (Plasterk, 2014).

The Dutch Minister of Foreign Affairs, Bert Koenders (2015), informed Parliament on the goals of the Urban Agenda program, stating that:

> *The Netherlands – together with the European Commission – is of the opinion that the economic and social potential of European urban areas can and should be better utilized. That is why the Netherlands is committed to improve the manner of proceeding at the EU level. The goal of the Urban Agenda is to focus and improve European legislation that unnecessarily limits urban development and to share knowledge about, as well as best practices for, innovative solutions to European urban challenges. During the presidency an international podium will be offered to Dutch urban innovation*.

Plasterk (2015) further elaborated developments around the Urban Agenda (see Annex 6), including a reflection on the consultation by the European Commission on the urban dimension of the EU (EC, 2014).

In this context, Telos, an academic center focused on regional sustainability challenges, part of Tilburg University in the Netherlands, took the initiative (with the support of the Dutch Ministry of Interior and Kingdom Relations) to perform a study benchmarking 114 EU cities and 31 Dutch cities of 100,000 inhabitants or more which would reveal the urban sustainability challenges in the EU. Since 2000, Telos has been developing a methodology to quantify the sustainability performance of cities and regions. This approach is similar to the European

Reference Framework for Sustainable Cities (RFSC, 2015), developed and promoted at a later date. In this study, sustainable development is defined in a broad sense, including not only ecological but also social and economic characteristics. This “3-P” (people-profit-planet) approach required the collection and analysis of a large amount of data on 50-100 indicators for the municipalities involved. As such data were not readily available on the national level, and even less so on European scale, in 2013, with the support of the European Commission’s Directorate-General for the Environment and the European Environment Agency in Copenhagen, as well as from the Triodos Foundation in Zeist, the Netherlands, Telos started a pilot project to collect such data for some 50 EU cities that had applied for the EU Green Capital Award (Zoeteman, van der Zande, Smeets, 2015). The pilot study demonstrated that the approach could work but would benefit from the inclusion of a larger number of cities which were more randomly selected, thus representing a wider range of sizes.

The present study fulfilled these conditions and also built on the experiences from the pilot study. It also aimed to establish an interactive website (www.sustainablecitiesbenchmark.eu) on which representatives of the cities involved could benchmark their city’s performance from different points of view in relation to other cities in general, or by comparing themselves with cities having a similar typology. In this way, cities can learn from each other as well as identify the necessary impetus that regional, national or EU authorities might be able to provide and thus design the optimum policy approach for their municipality or region.

1.2 Position of Telos researchers

While monitoring the sustainability of European cities and comparing the outcomes does provide the basis of a learning process, a mere ranking of cities does not provide sufficient data for a viable assessment of the sustainability challenges faced by municipal authorities. Moreover, such a monitoring instrument will be much more useful if it is developed on the basis of a joint exploration by researchers and government representatives. The researchers at Telos have thus positioned themselves as facilitators for authorities involved in designing and executing the best monitoring and related management practices. Monitoring should permit the assessment of integrated sustainability approaches in a fair and meaningful way; not only in view of general scientific findings, but also to provide guidance to local and other authorities.

1.3 The preparations for the study

This study reports the results of a sustainability performance assessment undertaken by Telos of 114 cities in Europe and 31 in the Netherlands. The study follows up on similar studies carried out in 2014 and 2015 across approximately 400 municipalities in the Netherlands (Zoeteman et al., 2014, 2015). These two national monitoring studies presented some interesting results, indicating that larger municipality size coincides with a better economic performance but an

increasingly lower performance on social and environmental sustainability. The overall results revealed that total sustainability scores progressively decrease once the population of municipalities exceeds 50,000 inhabitants. Furthermore, based on a city typology, it was found that the lowest sustainability scores were associated with characteristics such as a shrinking population, a history of industrial activities and a center function in the region, while higher scores were associated with green and growing cities. It was unclear, however, whether these findings were typical for the situation in the Netherlands or had wider international relevance. Furthermore, the extent to which the Dutch municipality was the right scale for assessing sustainability processes, which often cross municipal legal boundaries, remained a concern. Therefore a similar study at the EU level was initiated, first as a pilot. The European Environment Agency and its European Topic Centre for Spatial Information and Analysis supported the pilot study, allowing the use of part of its yet unpublished database, with individual Green Capital Award applicant cities participating in a questionnaire. The outcome of the draft pilot study was presented on 24 March 2015 at a seminar on “Measuring and Improving Environmental Performance in EU Cities” in Brussels, organized by the European Commission’s Directorate-General for the Environment. The pilot study report subsequently included comments from cities participating in the seminar and from Commission representatives, in particular representatives of the European Environment Agency and its Topic Centre for Spatial Information and Analysis, for which the authors are very grateful. These experiences were instrumental in the design and execution of the study presented here.

1.4 The growing need for urban sustainability monitoring

Sustainability monitoring at the level of cities is a field of growing interest. One reason for this interest is the need to understand how sustainability goals – such as the UN Millennium Development Goals of 2000 and the subsequent post-2015 Goals[1] – are effective at the urban level, where international and national policy objectives must be integrated and implemented.

The monitoring of and reporting on the sustainability of EU cities may support important functions, including:

- Assessing progress in improving urban sustainability, e.g., by introducing more efficient energy savings and sustainable energy technologies, sustainable procurement, sustainable mobility, etc.;
- Identifying mutually supportive interactions between the environmental, social and economic domains of local policymaking and development;
- Benchmarking cities of a similar sustainability typology to identify possible enhancing or restricting conditions that can be considered in policy actions in the context of the Lisbon Strategy and other community policy areas, such as cohesion, participation, recycling, mobility, greenhouse gas emissions reduction, etc.;

[1] http://www.un.org/millenniumgoals/

- Identifying key elements of a city's identity in comparison with characteristics of neighboring cities;
- Studying interactions between the urban activities and their geographical impact, and identifying key parameters for improving regional sustainable development;
- Identifying role models in certain categories of cities and regions;
- Stimulating cities to participate in systematic data collection and outcome sharing;
- Identifying recommendable improvements to the EU Urban Audit process and the Urban Agenda in view of sustainable development promotion.

International treaties on environmental and sustainable development have forced nations to monitor the implementation of these agreements. National organizations for monitoring and statistics, their European counterparts, such as Eurostat, ESPON, the European Environment Agency and JRC, as well as international institutions such as the UN Commission on Sustainable Development and the UN Climate Change Convention, have all been active in this field for years. These activities have resulted in elaborate overviews of the environmental, economic and social performance of states and the international institutions in which they participate.

However, a similar, integrated database at the city level is still under development and quite difficult to complete. Cities and municipalities are often not obliged to collect data according to a standardized methodology that allows for international comparison and benchmarking. At the same time, the implementation of government policies is becoming increasingly decentralized to the municipal level, and it is becoming widely recognized that cities play a crucial role in the implementation of many international and national policy initiatives. Moreover, the sustainability of cities is one of the 17 new goals of the post-2015 UN agenda: "Make cities and human settlements inclusive, safe, resilient and sustainable."[2]

Cities themselves also undertake sustainability initiatives, as demonstrated by the World Mayors Council on Climate Change[3] and Local Governments for Sustainability (ICLEI).[4] As a result of these developments, the need for well-organized urban sustainability monitoring is rapidly growing. The approach followed in this study may assist others in designing integrated sustainability monitoring practices.

1.5 Current efforts to monitor urban sustainability

A first difficulty in integrated sustainability monitoring is the interpretation of the concept of sustainable development. The concept is often limited to environmental or even climate change related themes. In the UN context, sustainable

[2] https://sustainabledevelopment.un.org/sdgsproposal

[3] http://www.worldmayorscouncil.org/home.html

[4] http://www.iclei.org/

development was defined in a broader sense by the 1987 Brundtland Commission to include environmental, economic and social issues, with governance issues also subsequently introduced. Sustainability goals for these broad issues must be defined and the related indicators assessed. However, the availability of reliable and comparable data for these indicators is a serious limitation. Data are mostly available for sub-aspects of sustainability, such as climate and energy, and often at a larger geographical scale than cities or municipalities. Socioeconomic developments have traditionally been measured and reported, and therefore data are more readily obtainable, for example, from Eurostat or the World Bank. However, an integrated database is still lacking.

Several, mostly voluntary, initiatives for more or less integrated sustainability monitoring of European cities are underway. One good example is the Reference Framework for European Sustainable Cities (RFSC),[5] an online toolkit that helps cities promote and enhance their work on integrated sustainable urban development, initiated after the Leipzig Charter of May 2007 by the EU Member States, the European Commission (EC) and others.

Another example, though more focused on environmental sustainability, is the process leading to the annual selection of the European Green Capital Award[6] for cities, which was launched in 2008 by the Directorate-General for the Environment based on an initiative by 15 European cities, which met in Tallinn, Estonia in 2006. The cities receiving the award are committed to ambitious goals and demonstrate a consistent record of high environmental standards, and they therefore can act as role models to inspire other cities. Since 2015, smaller cities – of 50,000-100,000 inhabitants – can apply for the European Green Leaf.

Another socioeconomic monitoring instrument that has been pursued for some time at a European urban level is the Urban Audit, carried out by Eurostat for the Directorate-General for Regional and Urban Policy with the help of national statistics organizations and other bodies. A first pilot of the Urban Audit started in 1999.[7] The Urban Audit assesses urban socioeconomic conditions across cities in the EU and for this purpose collects data every two to three years to help "improve the attractiveness of regions and cities as one of the priorities targeted by the renewed Lisbon Strategy and the EU's strategic guidelines for cohesion policy for 2007-2013." The first round of data collection took place in 2003/2004, followed by similar rounds in 2006/2007, 2009, 2011 and 2013. In 2009, data on 329 variables was to be collected for 323 EU cities and the number of variables and cities have since increased. However, not all Member States have fulfilled their commitments to provide data.

Parallel to the Urban Audit data collection, in 2006, 2009 and again in 2013, a Perception Survey was conducted in some 80 cities in the EU-27. The outcomes

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[5] http://www.rfsc-community.eu/about-rfsc/rfsc-at-a-glance/

[6] http://ec.europa.eu/environment/europeangreencapital/about-the-award/

[7] http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/introduction and http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-BD-04-002

were published in Eurostat's Regional Yearbooks. Combined with the websites of cities themselves, the Urban Audit data are currently the main sources of publicly available data on the sustainability of EU cities.

In addition, the website of the Covenant of Mayors provides systematic data on the greenhouse gas emissions of thousands of cities around the world and their commitment to reduce such emissions. In the future, the International Standardization Organization will also play an important role in standardizing city monitoring (ISO 37120). Furthermore, a Global City Indicators Program has been initiated by the World Bank, which encompasses monitoring, reporting, verifying, and amending indicators for city services and quality of life. It is a dynamic web-based resource that, since 2007, allows participating cities across the world to standardize the collection of their indicators and analyze and share the results and best practices on service delivery and quality of life.[8] This program is run by the Global City Indicators Facility based at the University of Toronto, which manages the development of indicators and assists cities to join the program.

One example of a private environmental sustainability report was published in 2009 by the Economist Intelligence Unit, sponsored by Siemens (Watson, Shields and Langer, 2009).[9] This European Green City Index for 30 leading European cities is based on the assessment of 30 environmental indicators and offers a tool to enhance the understanding and decision-making abilities of those interested in environmental performance. In 2015, Arcadis also published a sustainability index for 50 global cities using 20 indicators.[10]

There are many other monitoring initiatives, most of them limited to a specific theme, such as climate change, or to a geographical area. One example is the German Climate Cities Benchmark,[11] which collects and presents data on 17 indicators for 1,700 cities, regions and organizations in Europe, all of whom are paying members of the initiative. Another example is the European Energy Award[12] organization, in which 1,200 cities in Germany, France, Italy, Switzerland, Austria and Luxembourg participate. This organization allows cities to obtain a "European Energy Award®Gold" certificate from a certifying authority. The World Bank has also developed a tool (TRACE) that can quickly assess the energy status of a city.[13] This energy benchmark is based on 28 key performance indicators collected from 64 cities. Other energy-related data collection systems have been reported in Sweden[14] and Greece.[15]

[8] www.cityindicators.org

[9] http://www.siemens.com/entry/cc/features/greencityindex_international/all/en/pdf/report_en.pdf

[10] http://www.sustainablecitiesindex.com/

[11] http://www.klimabuendnis.org/our_members0.0.html

[12] http://www.european-energy-award.org/home/

[13] https://www.esmap.org/TRACE

[14] http://skl.se/tjanster/merfranskl/oppnajamforelser/energiochklimat.4538.html

[15] http://www.optimus-smartcity.eu/in_brief

Nonetheless, the integrated monitoring of city sustainability is the next step requiring further exploration. The present study makes a contribution in this direction.

1.6 What is a city?

An important issue to clarify in order to arrive at consistent urban sustainability monitoring is how best to define a city. The Directorate-General for Regional and Urban Policies, in cooperation with the OECD, has published such a definition and its implications for EU cities.[16] In its report *Cities in Europe: The New OECD-EC Definition*, by Dijkstra and Poelman (2012), cities are defined as municipalities with more than 50,000 inhabitants. Furthermore, they are considered to be based on high-density grid cells that collectively form an urban center. This urban center and the surrounding municipalities that share at least half of their population with the geographical urban center are considered to form a city. The document gives more specific details on the application of these general rules. Subsequently, it also defines Larger Urban Zones, consisting of the city and its commuting zone. Based on these definitions, Table 1.1 provides the following data for the EU.

Table 1.1 City types (sizes in population) in the EU (Dijkstra and Poelman, 2012)

Type	Population Sizes	Number of EU Cities
Small	50,000 – 100,000	420
Medium	100,000 – 250,000	268
Large	250,000 – 500,000	73
XLarge	500,000 – 1,000,000	41
XXLarge	1,000,000 – 5,000,000	24
Global City	More than 5,000,000	2
Total		828

In practice, a large part of the European population (40%) lives in municipalities that have fewer than 50,000 inhabitants, while only 25% live in cities of 250,000 or more inhabitants.[17] Dijkstra and Poelman (2012) conclude that “important differences in economic structure and functions, social composition, population size and demographic structure and geographical location shape the challenges

[16] http://ec.europa.eu/regional_policy/sources/docgener/focus/2012_01_city.pdf

[17] http://ec.europa.eu/environment/urban/pdf/annex_en.pdf

which urban areas face. National differences in traditions and culture, economic performance, legal and institutional arrangements and public policy have an important impact upon cities and towns. There is no single model of a European city." The sustainability challenges faced by EU cities, as well as their solutions, therefore, must be addressed to a large extent on an individual basis.

While Table 1.1 lists various city sizes starting at 50,000 inhabitants, very small municipalities of less than 50,000 inhabitants are absent mainly because international data collection for such municipalities was very difficult, or impossible, for the research team.

1.7 Setup of report

Chapter 2 will first discuss how the study was organized and which cities were selected. Chapter 3 describes the Telos approach to monitoring urban sustainability and the data sources used. Chapter 4 then presents the general outcomes with respect to the EU cities studied, while Chapter 5 discusses the results for the Dutch cities. Chapter 6 pays specific attention to the position of 26 EU capital cities, while Chapter 7 analyzes factors determining the sustainability performance of the EU cities studied. Finally, our conclusions are presented in Chapter 8.

2 Selection of cities studied

The pilot study mentioned above, carried out with the help of the European Commission's Directorate-General for the Environment and the EEA Topic Centre for Spatial Information and Analysis, resulted in a group of over 50 cities for which data were collected on more than 80 indicators. Governance themes were not included in the study because of an anticipated lack of sufficient data. For the present study, the selection of cities was expanded to include some smaller cities as well as larger cities that were not in the Green Capital Award applicants group, such as the major capitals of EU Member States, including London, Paris and Berlin.

After exploring the publicly available databases (including Eurostat, ESPON, Climate Covenant of Mayors), the team was able to produce data, or reasonable estimates based on data available at higher NUTS levels (mainly regional), for most of the indicators and for a total number of 114 cities in the EU. However, because of a lack of sufficient data in the EU databases at the present moment, no cities in the Member States of Croatia and Cyprus could be included.

The set of EU cities was complemented by 31 Dutch cities with over 100,000 inhabitants.

Table 2.1 Size distribution of EU and Dutch cities in the study

	Population sizes defined by legal EU city limits[18]	Number of EU cities in study	Number of Dutch cities of over 100,000 inhabitants in study
Small	45,000 – 100,000	22	
Medium	100,000 – 250,000	22	27
Large	250,000 – 500,000	24	1
XLarge	500,000 – 1,000,000	28	3
XXLarge	1,000,000 – 2,000,000	12	
Global City	More than 2,000,000	6	
Total		114	31

The group of 114 EU cities selected account for over 71 million people in total, which represents 14% of the EU population, living in the EU's most dense urban zones. The average size of the EU cities studied was 630,000 inhabitants, with size varying between 47,000 and 8,500,000. Smaller towns and villages – in which most of the EU population of over 507 million (2014) lives – are not represented in this study. This means that conclusions from this study only reflect the typical urban situation in Europe. Future studies should aim to include smaller cities and towns in order to obtain a more representative impression of the living conditions and developmental perspectives of the EU population as a whole.

The Dutch cities involved represent 6.2 million inhabitants, approximately one third of the country's population. The average size of the 31 Dutch cities selected is 199,000 inhabitants.

[18] This definition differs somewhat from the EC-OECD classification presented in Table 1.1, as most data in our study were collected for areas defined by legal city boundaries. On this basis, London has a much higher population (8.5 m) than Paris (2.3 m). However, the two cities have metropolitan zones of approximately similar size: for London this includes some 14 million people, and for Paris 12 million.

3 Methodology applied in urban sustainability monitoring and sources for data retrieval

This section discusses the methodology and data sources used. The method used by Telos largely resembles the aforementioned RFSC tool (see Section 1.5), developed since 2006 at the EU level. Telos has been independently developing its own method step by step since 2000 (Zoeteman, Mommaas, Dagevos, 2015; Zoeteman, 2012; Hermans et al., 2011; Dagevos and Van Lamoen, 2009; Knippenberg et al., 2007). One reason for its development was the political ambition of regional and local authorities in the Dutch province of North Brabant during that period to monitor whether the region was developing in a sustainable manner and was meeting its own sustainability goals. Since 2000, some 40 specific “sustainability balance” reports have been produced for local and regional authorities in the Netherlands.

3.1 The key elements of the Telos sustainability benchmark method

The sustainability balance instrument uses three pillars of sustainability (the ecological, sociocultural and economic domains) and their constituting subsystems. Sustainable development is considered to be a development process that aims to foster balanced growth, ensuring the resilience and quality of nature (“ecological capital”), the physical and spiritual wellbeing of people (“sociocultural capital”) and healthy economic development (“economic capital”). Following the UN Brundtland Commission report of 1987, sustainable development implies that three general requirements are met:

- There must be simultaneous improvement in the three forms of capital: ecological, sociocultural and economic. The improvement of one type of capital must not occur at the expense of one or both of the other types.
- It must be possible to sustain development for future generations: problems must not be passed on to the future.
- It must also be possible to sustain development at the global level. In other words, there must be no passing on of problems to other geographical areas.

Our development must not occur at the expense of those in other regions or other countries.

To determine whether a region or municipality is developing in a sustainable manner, monitoring is needed. However, this is not an easy task. What should be monitored and which reference framework should be used? Sustainable development not only includes development of the three forms of capital mentioned (ecological, sociocultural, economic), but also refers to dimensions of time (now and later) and space (here and there). Sustainable development, therefore, has a strategic as well as a normative dimension. It is no coincidence that the first rule of the Bellagio guidelines for the assessment of sustainable development states: “Assessment of progress towards sustainable development should be guided by a clear vision of sustainable development and goals that define that vision” (Hardi, 1997).

In order to be able to monitor the development of each form of capital and their relative positions, these have been broken down into subsystems called “stocks” using soft systems modelling (Checkland and Scholes, 1990). These stocks are important to the state and development of each form of capital, as well as to the system as a whole (see Figure 3.1).

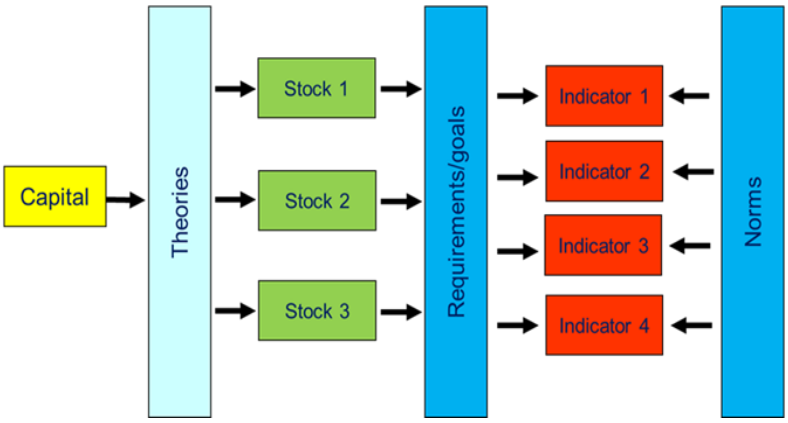


Figure 3.1 Construction of sustainability capital scoring, using stocks, goals, indicators and their sustainability norms

The sustainability balance instrument delineates stocks such as soil, water and air for ecological capital; social cohesion, health and education for sociocultural capital; and labor, infrastructure and mobility, and knowledge for economic capital. To develop sustainably, the stock values need to move in a certain direction towards a theoretically determined maximum goal. In this context, a number of long-term goals, called “requirements,” were formulated by the research team for each of the stocks; wherever possible, this was done in co-operation with stakeholders. These requirements are important reference points for the sustainability balance instrument, as they represent the long-term sustainability

vision of the region or municipality. Ideally, they are the result of an interactive process that involves different stakeholders aiming to develop a common vision; in most cases, however, it is not very difficult to reach consensus on long-term requirements. Examples are: (i) for the *soil* stock in ecological capital, the requirement is that the soil and groundwater are clean; (ii) for the *safety* stock in sociocultural capital, one requirement is that everyone living in a municipality should feel safe, and another is that the chance of becoming a victim of burglary should be negligible; and (iii) for the stock of *labor* in economic capital, the requirement is that labor market should be balanced (qualitatively and quantitatively) and work should be healthy (long-term illness and disability should be avoided).

The degree to which sustainability requirements are being met is measured using indicators. The development of indicator values over time provides an insight into the direction of development. A sustainability norm is specified for each indicator. The selection of indicators and their norms is often more sensitive to authorities than the definition of the long-term requirements discussed above. When Telos produces a sustainability balance report for a specific city, local stakeholders are also involved in the selection of indicators and norms. For the benchmark study discussed in this paper, the researchers selected the indicators and their norms based on literature and past experience, and these were subsequently applied to all cities. Table 3.1 summarizes the terms used and their definitions.

Table 3.1 Terms used to describe the sustainability of municipalities

Term	Description
Capital	The three essential subsystems of the entire social system: the ecological, sociocultural and economic aspects.
Stock	The essential subsystems which together with other stocks determine the quality and quantity of one form of capital.
Requirement	Long-term goal(s) that specifies or specify the sustainability challenge for a stock.
Indicator	Measurable characteristic that can be used to operationalize the requirement.
Norm	Sustainability standard by means of which the scores on indicators can be quantitatively assessed and expressed as % of long-term goal achievement.

How norms are used in the calculation of sustainability scores – expressed as a percentage of sustainability goal achievement and based on the actual data for the indicators – is discussed in Section 3.2.

Municipalities are considered more sustainable when the total sustainability score is higher and the deviation of the individual capital scores from the average, based on the total score, is smaller. Sometimes municipalities have a high score for one form of capital (e.g. an economic capital score of 60% achievement of the sustainability goal), while the other two forms of capital score much lower (e.g. 35% and 40%). Time series analysis will be able to determine whether the form of capital scoring higher is developing at the expense of the other two forms. A relatively low-scoring form of capital will trigger the attention of the authorities, prompting them to analyze the causes and consider remedial policy actions.

3.2 The actual design of the scoring instrument

Sustainability requirements have been defined for each of the stocks of the three capitals (see Annex 1). This was done by the Telos team based on local, regional, national and European policy documents and the actual performance of major cities in the Netherlands. Subsequently, indicators were selected for each stock, based on the requirements. Table 3.2 gives an overview of the 20 stocks distinguished and the 86 indicators used to measure their performance.

The number of indicators used in this study was limited by the availability of data but also by the fact that adding more indicators to measure a certain stock adds less and less to the outcome. Finding useful indicators depends, for example, on the availability of data for all of the cities involved, their comparability in space and time, and the frequency of measurement of the indicators. Having determined the indicators that could be used, a scale for each was constructed using a set of specific norms for each indicator that measured progress towards sustainability, expressed as a percentage of the operational sustainability goal of that indicator (varying from 0%, the lowest and an unacceptable score, to 100%, the highest achievable long-term score). One example of such an indicator for the labor stock concerns the level of unemployment in the labor market. The sustainability goal for the labor stock is that the labor market should be balanced (quantitatively and qualitatively).

Table 3.2 The forms of capital, stocks and indicators used to assess municipal sustainability

Capital	Stock	Number of indicators	Indicators
Ecological	Soil and groundwater	2	Chemical status groundwater, Nitrogen surplus in soil
	Drinking water and sanitation	4	Public water supply consumption, Household consumption, People connected to wastewater collection system, People connected to secondary or better wastewater treatment
	Surface water	4	Soil sealing, Ecological status, Chemical status, Increased flood risk due to heavy rainfall
	Air	6	Concentration of ozone, PM10 and PM 2.5; Annual emissions per capita of nitrogen oxides (NOx) and ammonia (NH3); Perception of seriousness of air pollution
	Annoyance and emergencies	6	Road, Rail and Airport noise >55dB and >65dB, Perception noise annoyance
	Nature and landscape	6	Urban green area, Urban blue area, Urban red area, Agricultural area, Natura 2000 area, Quality of natural area
	Energy and climate	3	Annual GHG emissions in CO2 eq. per capita, Emission reduction target 2010-2020, Realized emission reduction 1990-2010
	Resources and waste	3	Annual municipal solid waste generated per capita, Landfilling, Incineration
Sociocultural	Economic participation	2	Long-term unemployment rate, Poverty
	Political participation	4	Turnout municipal, national and European elections, Political trust
	Social participation	2	Perception that foreigners are good for society, Perception that most people can be trusted

	Health	5	Infant mortality, Hospital beds, Availability General Practitioners, Life expectancy, Satisfaction with health facilities
	Arts and culture	5	Museum visitors, Theaters, Satisfaction with cultural facilities, Nights spent in tourist accommodations, Public libraries
	Safety	5	Intentional homicide, Burglary, Robberies, Traffic fatalities, Perception of safety
	Residential environment	5	Net migration, Rental price, Satisfaction with living in this city, Satisfaction with house, Satisfaction with sports facilities
	Education	4	Youth unemployment, Early leavers from education, Secondary education, Satisfaction with schools
Economic	Labor	4	Employment rate, Unemployment rate, Employment function, Aging labor force
	Competitiveness	5	Disposable income, Starting businesses, Ended businesses, GDP/capita PPS, Employment growth
	Infrastructure and mobility	6	Broadband connection internet, Length of cycle lanes, Congestion of motorways, Distance to closest major airport, Cars registered, Satisfaction with public transport
	Knowledge	4	High (tertiary) education, Employment high technology, Employment creative class, R&D intensity

The level of unemployment indicates whether the labor market is quantitatively in balance or not. An unemployment level below 4% is considered socially optimal (equivalent to an indicator score between 75% and 100%), between 4% and 7% socially acceptable (an indicator score between 50% and 75%), between 7% and 10% socially alarming (an indicator score between 25% and 50%) and above 10% socially unacceptable (an indicator score between 0% and 25%). An unemployment percentage of 4.2% is thus a socially acceptable result, leading to an indicator score of 73%.

Applying this assessment method, each actual indicator score is expressed as a percentage of the sustainability goal achieved. A total score for each stock is determined by adding the weighted scores of the indicators involved. A general example of how the weighting of indicators for one stock was done is given in Table 3.3. In the present study indicators have been given equal weight within a stock.

Table 3.3 Example of weighting indicators in calculating a stock score when requirements are of equal importance (weighting in %)

Measurement terms			**Weighting in %**
Stock 1	Requirement 1	Indicator 1	25.00
		Indicator 2	25.00
	Requirement 2	Indicator 3	16.67
		Indicator 4	16.67
		Indicator 5	16.67
			100.00

An extended description of the method used can be found in Zoeteman, Van der Zande and Smeets (2015).

The stock scores are then added, with equal weight, to calculate the capital score. Finally, the three forms of capital are weighted equally to calculate the overall sustainability score for a city, expressed as the average percentage of the overall achievement of sustainability goals.

3.3 Availability of data and data estimations

The data used in this study were obtained from Eurostat, ESPON, the European Environment Agency (including the Urban Atlas), the European Cities Monitor (Cushman and Wakefield, 2011), the Covenant of Mayors website, the DG

Regional and Urban Policies, the DG Environment, the WISE WFD Database, and the websites of the cities concerned. Annex 2 describes the indicator definitions and data used. Some data could only be obtained at NUTS 2 or NUTS 3 level. In such cases, they were translated to city level, for example, by allocation of a proportional part of the indicator value from the NUTS level extrapolated to the city level according to the population size. In exceptional cases, particularly those relating to perception surveys, data from another city of the same Member State were used. These cases are described in Annex 3.

4 Comparison of the sustainability scores of EU Cities

4.1 Total sustainability scores of EU cities

A survey of the main results of the monitoring study of 114 EU cities is presented in Table 4.1. This table lists the cities in alphabetical order. An overview based on the order of the total scores is given in Annex 4.

The highest-scoring cities, with total sustainability scores above 60%, are mainly found in Scandinavia and Germany (with the exceptions of Luxembourg and Innsbruck). In descending order these are Espoo, Copenhagen, Stockholm, Munich, Helsinki, Luxembourg, Linköping, Umeå, Tampere, Nuremberg and Innsbruck.

Figure 4.1 Espoo, Finland, situated in the vicinity of Helsinki

The lowest scoring cities, with total scores below 40%, are Naples, Thessaloniki, Constanta, Vidin, Athens and Larissa, nearly all bordering the Mediterranean or the Black Sea.

Figure 4.2 Naples, Italy, adjacent to Vesuvius and bordering on the Mediterranean Sea

As in the pilot study (Zoeteman, van de Zande, Smeets, 2015), a strong north-south gradient is detected.

Table 4.1 Overview of total sustainability and capital scores of 114 EU cities

City	Total Score	Ecological score	Socio-cultural score	Economic score
Amsterdam	58.1	58.0	55.4	61.0
Antwerp	53.6	51.2	54.8	54.7
Arras	47.4	46.2	44.6	51.3
Athens	39.0	37.5	33.3	46.0
Barcelona	48.2	50.0	45.3	49.3
Belfort	51.9	52.2	51.5	52.0
Berlin	54.2	60.2	48.8	53.4
Białystok	43.8	47.0	47.9	36.6
Bordeaux	53.7	55.6	52.7	52.9
Braga	44.0	52.3	43.7	36.0
Brașov	44.0	58.1	44.5	29.3
Bratislava	54.1	56.6	50.0	55.7
Bremen	56.0	60.6	51.7	55.7
Brighton and Hove	52.3	53.6	51.2	52.1
Bristol	52.8	53.2	49.0	56.2
Brno	51.5	50.8	52.6	51.2
Brussels	51.1	57.1	44.0	52.0
Bucharest	45.7	46.8	43.3	46.8
Budapest	49.4	50.9	49.3	48.1
Bydgoszcz	44.6	48.1	45.9	39.8
Cluj-Napoca	47.3	56.0	47.7	38.2
Constanta	37.4	52.1	33.4	26.7
Copenhagen	63.9	62.8	62.7	66.0
Dublin	52.2	50.2	52.1	54.3
Espoo	65.0	63.5	66.5	65.0
Essen	53.7	57.1	54.1	49.8
Florence	48.0	45.1	51.1	47.7
Frankfurt	58.5	59.8	57.3	58.6
Freiburg	58.3	62.3	58.6	54.1
Galway	49.5	55.6	45.9	47.1
Ghent	52.8	47.0	56.9	54.3
Glasgow	50.7	51.5	52.3	48.2
Hamburg	59.3	60.6	57.0	60.3
Hannover	54.2	59.5	51.4	51.6
Helsinki	63.2	58.7	64.8	66.0
Innsbruck	60.9	58.6	62.3	61.6

City	Total Score	Ecological score	Socio-cultural score	Economic score
Jelgava	44.6	57.7	33.8	42.3
Karlovy Vary	45.9	52.7	45.2	39.9
Karviná	45.0	49.8	45.2	40.1
Kaunas	47.9	58.0	43.7	42.1
Klaipėda	47.4	57.7	42.5	41.8
Kortrijk	50.7	44.6	54.7	52.7
Kraków	45.6	43.1	50.2	43.5
Larissa	39.1	49.1	38.4	29.9
Lelystad	54.8	61.8	49.3	53.2
Lille	47.3	46.1	43.4	52.4
Limerick	52.2	54.4	49.2	53.0
Linköping	62.9	65.6	63.8	59.3
Lisbon	46.8	48.5	44.2	47.7
Ljubljana	56.6	54.4	58.9	56.4
Łódź	41.4	39.7	45.5	39.1
London	53.3	49.0	49.4	61.5
Luxembourg	62.9	54.5	70.3	64.1
Madrid	50.2	53.4	43.7	53.5
Magdeburg	52.1	60.7	50.0	45.6
Málaga	44.1	50.0	41.4	40.8
Malmö	57.3	61.0	56.8	54.2
Manchester	49.0	48.5	50.1	48.3
Marseille	48.1	54.9	39.1	50.3
Middelburg	53.6	55.2	56.0	49.7
Milan	45.7	40.8	46.8	49.4
Miskolc	42.3	55.9	37.7	33.3
Munich	63.6	61.6	67.7	61.5
Munster	57.1	61.7	57.4	52.2
Murcia	47.4	57.6	44.3	40.4
Nantes	54.7	56.0	55.2	52.7
Naples	35.0	36.3	33.1	35.5
Narva	47.5	61.6	40.4	40.6
Newcastle	50.5	51.7	53.7	46.0
Nijmegen	57.6	57.5	57.5	57.8
Nuremberg	61.6	61.5	64.1	59.3
Olomouc	47.2	49.0	50.3	42.3

City	Total Score	Ecological score	Socio-cultural score	Economic score
Ostrów Wielkopolski	44.3	44.0	45.2	43.7
Oulu	58.9	64.4	61.7	50.6
Pamplona	49.9	45.8	53.6	50.2
Paris	51.4	43.5	51.0	59.8
Piatra Neamț	45.1	62.4	44.6	28.3
Pitești	41.7	61.4	35.2	28.5
Porto	45.9	49.7	47.9	40.1
Prague	54.9	47.9	57.2	59.6
Prešov	44.0	53.0	42.2	36.9
Reggio Emilia	46.2	41.1	49.2	48.1
Rennes	54.6	52.7	56.7	54.3
Riga	46.5	56.1	38.6	44.8
Rome	41.3	41.7	36.8	45.3
Rotterdam	53.9	57.5	48.6	55.6
Santander	46.6	43.6	50.6	45.5
Seville	45.9	50.1	43.3	44.2
Sofia	47.7	55.4	39.3	48.4
Stockholm	63.8	60.8	67.0	63.7
Stoke-on-Trent	46.9	48.7	48.4	43.7
Szombathely	48.2	56.8	47.4	40.2
Tallinn	51.6	60.6	46.3	47.9
Tampere	61.8	66.9	65.2	53.4
The Hague	55.9	60.0	52.3	55.4
Thessaloniki	35.1	41.0	31.3	32.8
Toruń	45.4	49.4	48.8	37.9
Toulon	50.4	58.3	42.1	50.9
Tours	52.6	54.7	49.9	53.2
Trenčín	43.1	52.9	40.8	35.6
Turin	45.2	45.7	43.8	46.1
Umeå	61.9	70.6	61.9	53.1
Valencia	44.8	50.2	39.7	44.4
Valletta	47.9	39.1	52.8	51.7
Valongo	43.7	46.8	44.0	40.1
Vidin	38.0	50.8	34.4	28.8
Vienna	58.4	58.6	56.0	60.5
Vilnius	49.2	59.2	42.8	45.5
Viseu	45.9	59.6	45.6	32.5

City	Total Score	Ecological score	Socio-cultural score	Economic score
Vitoria Gasteiz	51.8	50.9	53.9	50.8
Warsaw	49.7	46.7	49.1	53.2
Waterford	53.4	53.9	50.9	55.5
Yambol	41.3	51.7	39.6	32.5
Zaragoza	46.0	54.8	40.8	42.5

4.2 Sustainability scores for the three forms of capital in EU cities

A closer look at the three forms of sustainability capital reveals the underlying drivers of the total sustainability score results.

Again, the best ecological scores are found in several Scandinavian cities. The ecological top-ten cities scored above 61% and include, in descending order, Umeå (70.6%), Tampere, Linköping, Oulu, Espoo, Copenhagen, Piatra Neamț, Freiburg, Lelystad and Munster (61.7%). The lowest ecological scores, of less than 40%, were found for Naples (36.3%), Athens, Valletta and Łódź (39.7%).

In relation to sociocultural capital, Luxembourg (70.3%), Munich and Stockholm lead the list, followed by Espoo, Tampere, Helsinki, Nuremberg, Linköping, Copenhagen and Innsbruck (62.3%). The lowest scores were detected in Thessaloniki (31.3%), Naples, Athens, Constanta, Jelgava and Vidin (34.4%).

The trend for economic capital is similar, with northwestern European cities overrepresented in the high-scoring group. They include Helsinki (66.0%), Copenhagen, Espoo, Luxembourg, Stockholm, Innsbruck, Munich, London, Amsterdam and Vienna (60.5%). At the lower end are Constanta (26.7%), Piatra Neamț, Pitești, Vidin, Brașov and Larissa (29.9%), all with an economic capital score below 30%.

This brief presentation of the outcomes appears to indicate that all three capital scores are either higher or lower in the cities concerned. The following chapters will further discuss whether this is indeed a general trend or not.

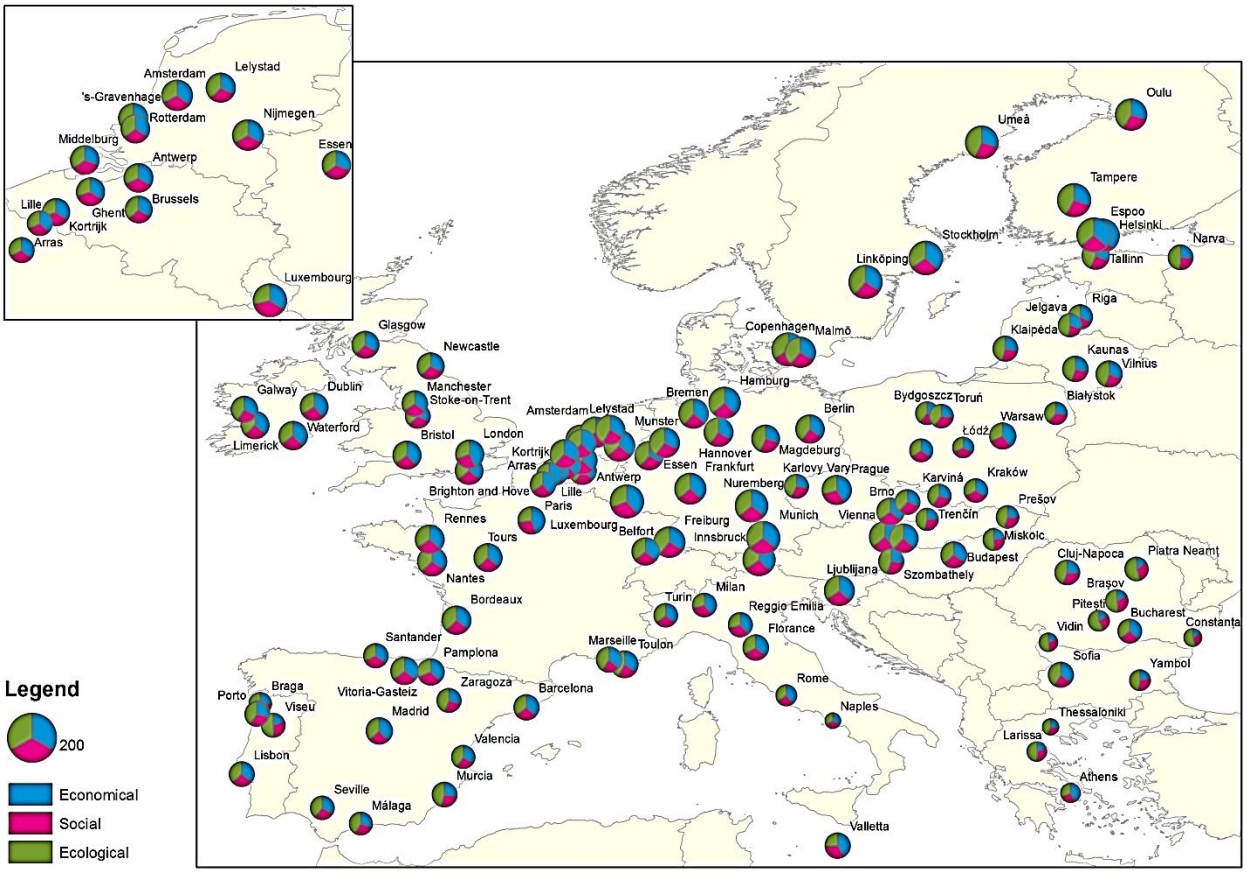


Figure 4.3 Overview of total sustainability and sustainability capital scores for 114 EU cities

5 Comparison of Dutch cities with their EU counterparts

This chapter will describe the characteristics of the Dutch cities studied and how they compare to the EU situation.

5.1 Total sustainability scores of Dutch 100,000+ cities

Table 5.1 shows the outcomes for the cities with a population of more than 100,000 in the Netherlands. Readers familiar with the results of the Dutch National Monitor for Sustainable Cities should be aware that total scores in this overview differ from the total scores in the Dutch National Monitor because indicators included in the latter could not always be used in the EU study. Furthermore, the total number of indicators in the present study is also lower. Among other consequences, this meant individual indicators carried different weight in the overall outcome. In this study, the choice was made to make the Dutch cities comparable with the EU cities, meaning that the more detailed Dutch national monitor results could not always be used. Table 5.1 shows that differences between Dutch cities are relatively small. These small differences in outcomes have sometimes resulted in a considerably different position of Dutch cities in relation to each other in this study, compared to the Dutch monitor. This should be given less weight than the differences between the group of Dutch cities and other EU cities discussed in this study.

The lower range of variation of the scores for the Dutch cities, compared to the EU cities, is due to factors such as less variation in size and a more homogeneous socioeconomic context.

Table 5.1 Overview of total and sustainability capital scores of 31 Dutch cities

City	Total score	Ecological score	Socio-cultural score	Economic score
Alkmaar	55.8	51.0	58.1	58.5
Almere	56.4	63.7	51.4	54.0
Alphen aan den Rijn	56.1	59.2	54.0	55.0
Amersfoort	59.5	56.9	59.1	62.5
Amsterdam	58.1	58.0	55.4	61.0
Apeldoorn	59.5	61.6	59.6	57.3
Arnhem	56.2	55.4	56.8	56.5
Breda	54.8	51.9	54.1	58.3
Delft	55.5	55.3	55.1	56.0
Dordrecht	57.2	62.6	55.5	53.4
Ede	58.5	60.9	59.6	54.9
Eindhoven	54.1	47.4	53.7	61.2
Emmen	56.4	60.3	57.6	51.2
Enschede	54.3	56.7	54.3	51.9
Groningen	57.7	57.4	59.4	56.2
Haarlem	59.1	59.6	59.2	58.4
Haarlemmermeer	58.9	54.4	58.4	64.0
Leeuwarden	54.3	57.9	54.0	51.1
Leiden	55.4	54.1	55.3	56.7
Maastricht	54.8	57.5	54.2	52.9
Nijmegen	57.6	57.5	57.5	57.8
Rotterdam	53.9	57.5	48.6	55.6
's-Hertogenbosch	55.7	51.9	55.6	59.6
The Hague	55.9	60.0	52.3	55.4
Tilburg	55.4	52.5	55.9	57.9
Utrecht	59.0	56.3	57.4	63.4
Venlo	55.5	55.9	55.6	54.9
Westland	54.1	55.7	54.7	52.0
Zaanstad	58.2	59.8	58.0	56.8
Zoetermeer	55.8	59.8	50.8	56.8
Zwolle	57.5	60.2	57.7	54.5

5.2 How do Dutch cities compare in general with the EU cities studied?

Figure 5.1 presents mean values and ranges for the groups of Dutch and EU cities studied. For all three forms of sustainability capital, Dutch cities score, on average, higher than the corresponding EU cities. This could be expected, given the relatively northern position of the Netherlands in the EU-28.

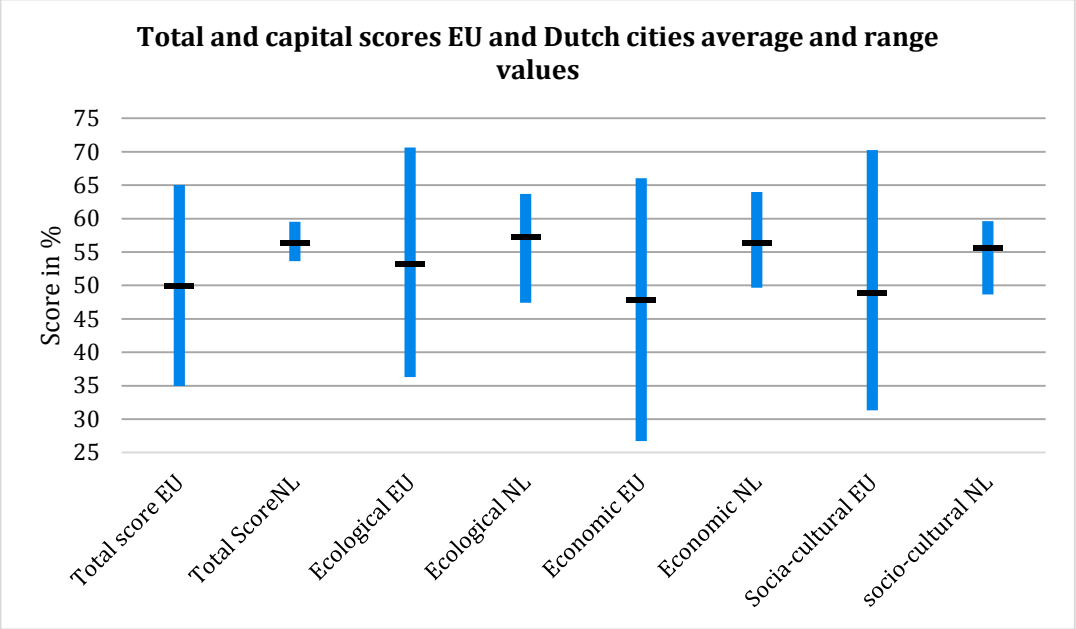


Figure 5.1 Differences between total and capital scores for 31 Dutch and 114 EU cities

In the group of Dutch cities, the range of scores is largest for ecological capital, while in the EU group, economic capital scores vary the most. The mean economic capital score of EU cities is also below the mean value of the EU total score. The average ecological capital scores of Dutch cities deviates least from the EU average value, while the mean economic capital value of the Dutch group deviates (in a positive sense) most from the EU group.

5.3 How do Dutch cities compare with EU cities of the same size and EU region?

Here a comparison of the Dutch cities will be made with a selection of EU cities of the same size and regional position in the EU. For this purpose, cities with 100,000 to 900,000 inhabitants in member states that also border the North Sea were chosen. They are in Belgium, Denmark, Germany, Sweden and the UK. The list of cities is presented in Annex 5, with some also represented in Figure 5.2.

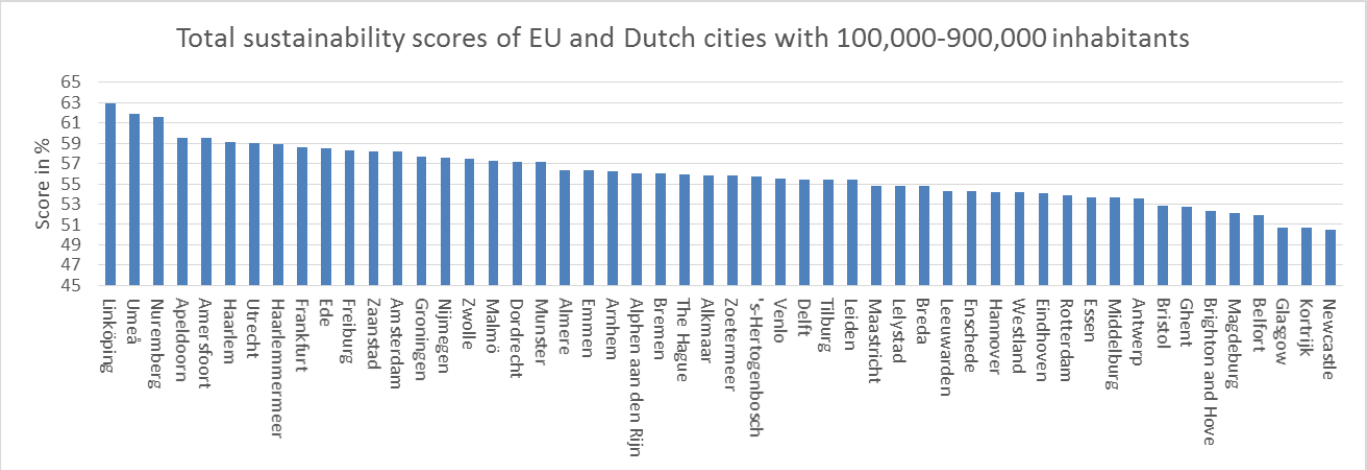


Figure 5.2 Comparing 31 Dutch and 20 similar sized EU cities of states bordering the North Sea

Figure 5.2 shows that the Dutch cities lie in the middle of the EU group of cities with similar characteristics, although Linköping, Umeå and Nuremberg outperform Apeldoorn, the best scoring Dutch city in this study. Several UK cities score at the lower end of this selection; Amsterdam scores somewhat lower than Frankfurt; and Antwerp, Enschede and Rotterdam have nearly identical scores.

6 A comparison of European capital cities

6.1 The historical backgrounds of European capital cities

This chapter will briefly characterize EU capital cities from a sustainability point of view. Their present situation is, of course, in some cases the result of millennia of development, of which remnants can still be found in city structures and the socioeconomic atmosphere of cities.

Most European capital cities are former seats of power of regional or even global empires. In the Mediterranean region, Athens and Rome were the former centers of the Greek (approx. 800 - 400 BC) and Roman (approx. 400 BC - 450) empires, respectively.

In later ages the Vikings dominated (approx. 800-1100), their power extending from Scandinavia and its harbors in Copenhagen and Stockholm to the European coast of the North Sea and the Channel, all the way to the Mediterranean and Black Sea. In subsequent centuries (1300-1700), a lively trade market developed in the form of the Hanseatic League, a commercial and defensive confederation of merchant guilds and their market towns located around the Baltic and the North Sea. It included cities such as Novgorod, Tallinn, Riga, Stockholm, Gdansk, Lübeck, Hamburg, Bergen, Kampen, Bruges and London, and can in a sense be seen as a precursor of the EU.

After discovering the American continents, the Spanish and Portuguese empires thrived on trade with American and African colonies (approx. 1500-1800). Spain also dominated in Europe in this period, including the territories of present Belgium and the Netherlands.

Antwerp, a dominant global port in the sixteenth century, freed themselves from Spanish domination, later followed by the United Provinces of the Netherlands. Subsequently, many Protestant merchants moved from the wealthy Belgian ports to Amsterdam, which became one of the most important ports in the world in the seventeenth century, trading with mainland Europe and the Baltic cities, as well as expanding the Dutch East India Company, the world’s first multinational corporation, with colonies in the Americas, Africa, India and Japan.

The French and British had immense global empires, with Paris and London their eminent centers, and their power extending from approx. 1600 to approx. 1950. Also the Portuguese expanded their territory globally.

Parallel to these merchant economies, the Austrian or Habsburg Empire (1520-1918), including Austria, Bohemia and Hungary, dominated the heart of the European continent for a long period, based in the illustrious cities of Vienna, Budapest and Prague.

As a result of the waves of early globalization and subsequent industrialization, the capital cities of these empires accumulated enormous riches, which can still be detected in their architecture, arts and city planning. Some capital cities, however,

are currently passing through a period of decline, while others are growing and thriving.

This chapter will present the actual facts for 26 EU capital cities in more detail, while later chapters will discuss specific sustainability issues and the common challenges for all of the EU cities studied.

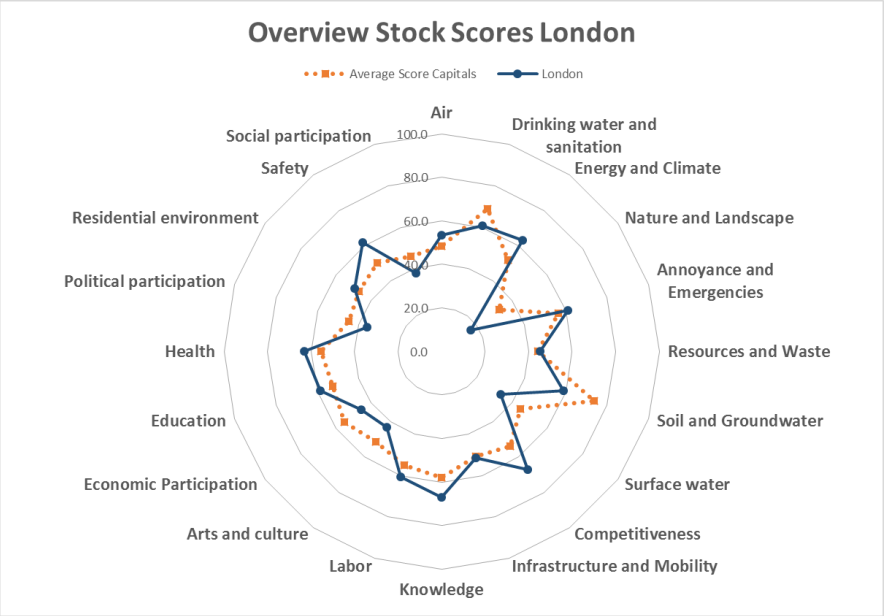
6.2 Comparison of capital cities

Sustainability characteristics gain in meaning through a comparison of cities that have several aspects in common. In the next chapter, city typology will be included in an assessment of differences and commonalities. Here, cities will be compared in clusters wherever possible, and assembled according to size and geographical proximity or comparability.

The following clusters will be discussed:

- Berlin (3.4 m), London (8.5 m) and Paris (2.3 m)
- Madrid (3.2 m) and Rome (2.8 m)
- Budapest (1.7 m) and Vienna (1.8 m)
- Prague (1.3 m) and Warsaw (1.7 m)
- Athens (0.66 m), Bucharest (1.9 m) and Sofia (1.2 m)
- Amsterdam (0.83 m), Brussels (1.1 m) and Copenhagen (0.58 m)
- Helsinki (0.63 m) and Stockholm (0.95 m)
- Riga (0.66 m), Tallinn (0.44 m) and Vilnius (0.54 m)
- Dublin (0.53 m) and Lisbon (0.55 m)
- Bratislava (0.42 m) and Ljubljana (0.28 m)
- Luxembourg (0.09 m) and Valletta (0.20 m)

6.3 Berlin, London and Paris


Overview Stock Scores London
Average Score Capitals
London
Air
Drinking water and sanitation
Energy and Climate
Nature and Landscape
Annoyance and Emergencies
Resources and Waste
Soil and Groundwater
Surface water
Competitiveness
Infrastructure and Mobility
Knowledge
Labor
Arts and culture
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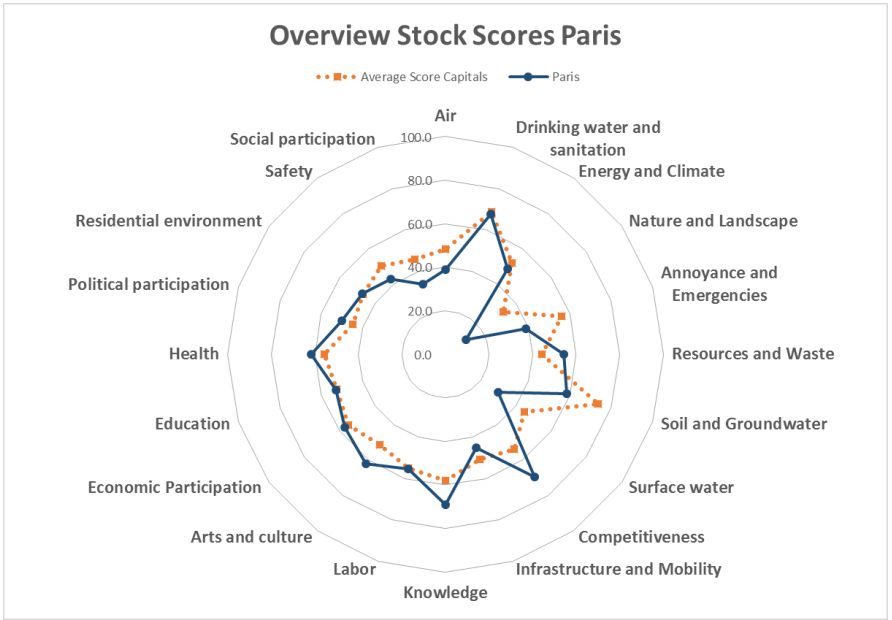
Overview Stock Scores Paris
Average Score Capitals
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Nature and Landscape
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Competitiveness
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Three of the global cities of the EU, Berlin (3.4 m), London (8.5 m) and Paris (2.3 m), all located in the central region of the EU, are characterized here using spider diagrams of their stock scores. It should be noted, as mentioned earlier, that the size of these cities does not reflect their urban zones, particularly in the case of Paris. Table 6.1 presents the total sustainability and the three sustainability capital scores for these cities.

Table 6.1 Total sustainability and capital scores for Berlin, London and Paris

City	Total score	Ecological score	Socio-cultural score	Economic score
Berlin	54.2	60.2	48.8	53.4
London	53.3	49.0	49.4	61.5
Paris	51.4	43.5	51.0	59.8

Berlin scored highest of the three cities on total sustainability and on ecological capital, but lowest on economic capital. London scored best on economic capital, and Paris highest on sociocultural capital but lowest on ecological capital.

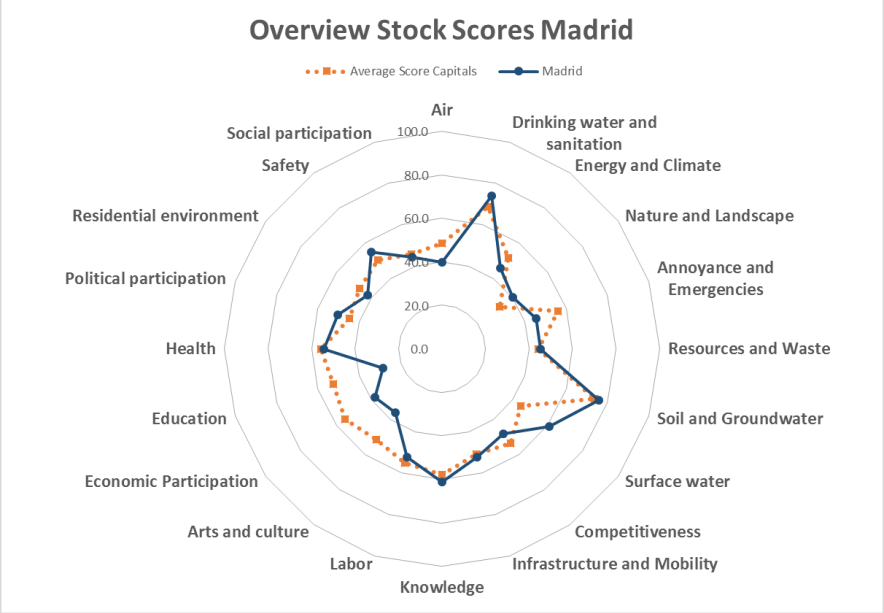
The spider diagrams, including the mean stock scores for the total group of 26 capital cities as a reference, show that Berlin has the most balanced outcome.

A closer look at the spider diagrams of stock scores indicates that all three cities score above average on “resources and waste” (waste collection and recycling), “knowledge,” “competitiveness” and “health.” However, “nature and landscape” and “surface water” score below average in London and Paris. “Energy and climate” shows a better than average score in Berlin and London. “Arts and culture” scored above average in Paris. “Residential environment” scored highest in London.

Overall, these three cities with multi-million inhabitants have profiles that are close to the average profile of EU capital cities, with a few exceptions.

6.4 Madrid and Rome

The two other EU cities with multi-million inhabitants, Madrid (3.2 m) and Rome (2.8 m), are located in the southern region of the EU.



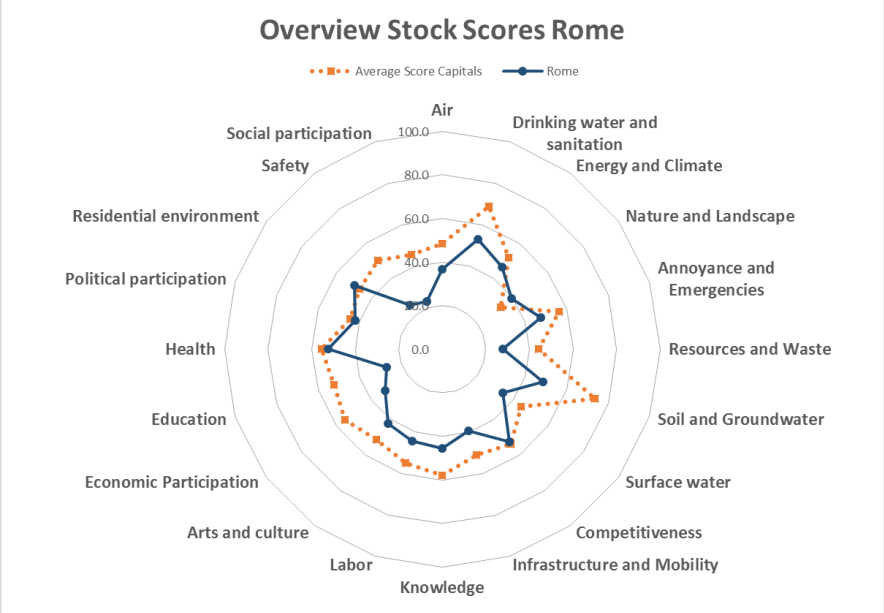


Table 6.2 Total sustainability and capital scores for Madrid and Rome

City	Total score	Ecological score	Socio-cultural score	Economic score
Madrid	50.2	53.4	43.7	53.5
Rome	41.3	41.7	36.8	45.3

The total scores for Madrid and Rome are lower than all three capital cities discussed above, as shown in Table 6.2. All three sustainability capital scores are less favorable in Rome than in Madrid. Similarly to Berlin, both cities show the lowest scores for sociocultural capital, indicating particular social challenges in the fields of “education” and “economic participation.” However, both cities have scores on “health” and “political participation” that are similar to the average EU capital city.

Overall, Madrid’s profile generally matches the average EU capital city profile. However, Rome’s sustainability profile scores below the average capital city profile on most stock scores, with favorable exceptions for “nature and landscape,” “competitiveness” and “residential environment.”

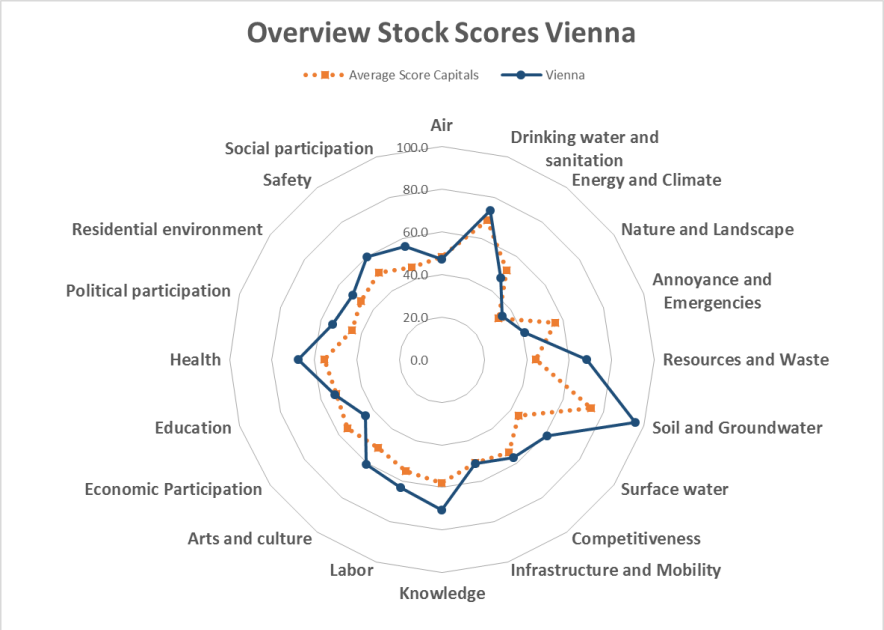
6.5 Budapest and Vienna

Budapest (1.7 m) and Vienna (1.8 m) have old roots and rich histories, as do the previously discussed cities. As shown in Table 6.3, Vienna has a very favorable total sustainability score, the highest of the cities discussed so far, while Budapest is a closer match to the profile of Madrid discussed above, although Madrid has a better economic performance score than Budapest.

Table 6.3 Total sustainability and capital scores for Budapest and Vienna

City	Total score	Ecological score	Socio-cultural score	Economic score
Budapest	49.4	50.9	49.3	48.1
Vienna	58.4	58.6	56.0	60.5

At stock level, Budapest scores below average on “surface water” and “infrastructure and mobility,” but relatively high on “nature and landscape” and “economic participation.” In Vienna, practically all stocks score above average, except for “annoyance,” for example, due to noise, and “economic participation.” Very favorable scores are found in Vienna for ecological stocks such as “resources and waste,” “soil and groundwater” and “surface water,” as well as the economic stock of “knowledge” and the sociocultural stock of “health.” Only London has a better economic capital score than Vienna.


Overview Stock Scores Vienna
Average Score Capitals
Vienna
Air
Drinking water and sanitation
Energy and Climate
Nature and Landscape
Annoyance and Emergencies
Resources and Waste
Soil and Groundwater
Surface water
Competitiveness
Infrastructure and Mobility
Knowledge
Labor
Arts and culture
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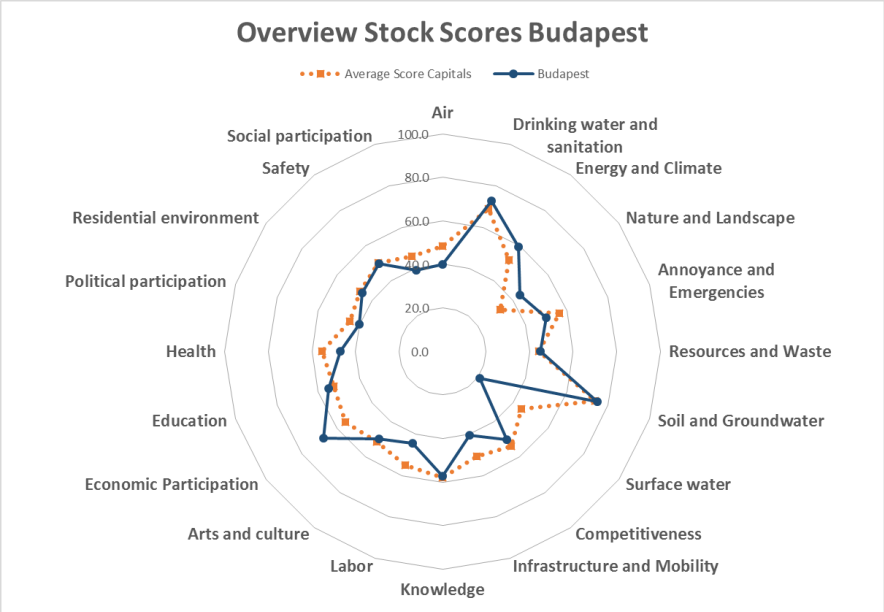
Overview Stock Scores Budapest
Average Score Capitals
Budapest
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Drinking water and sanitation
Energy and Climate
Nature and Landscape
Annoyance and Emergencies
Resources and Waste
Soil and Groundwater
Surface water
Competitiveness
Infrastructure and Mobility
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Arts and culture
Economic Participation
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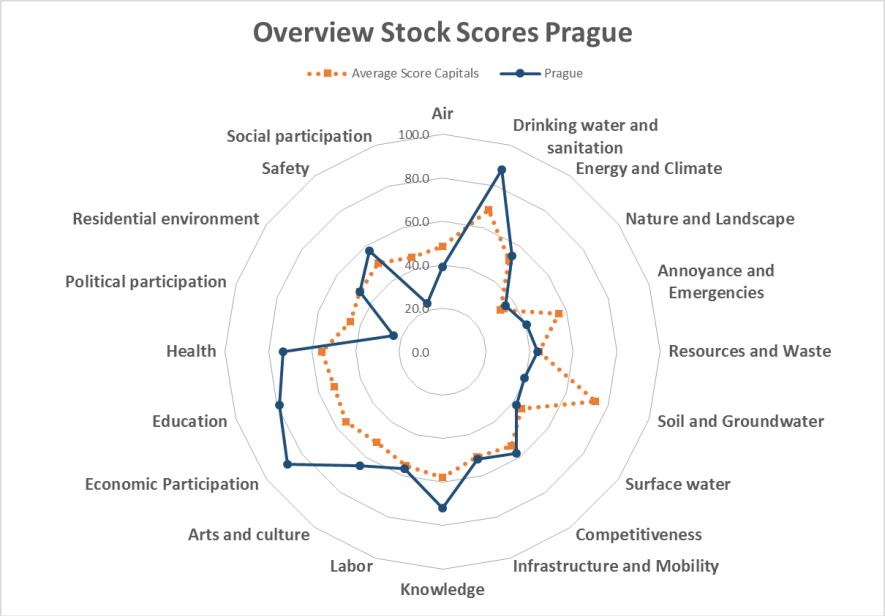
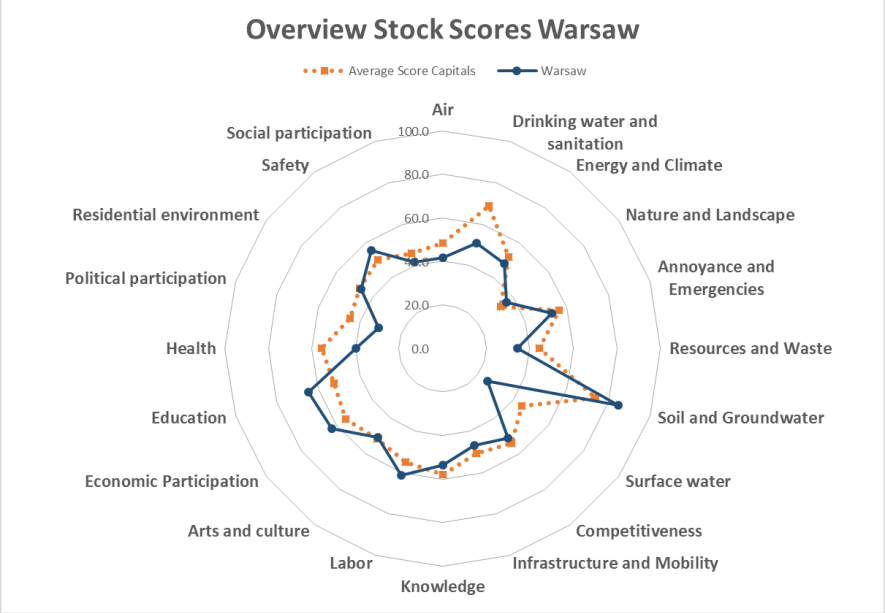
6.6 Prague and Warsaw





Prague (1.3 m) and Warsaw (1.7 m) exhibit significant differences at stock level. Prague deviates more strongly from the average profile than Warsaw, both positively ("drinking water and sanitation," "knowledge," "arts and culture," "economic participation," "education" and "health") and negatively ("annoyance," for example, by noise, "soil and groundwater," "political and social participation"). Warsaw has below average stock scores for "air," "drinking water and sanitation," "surface water," "health", "Resources and Waste" and "political participation." "Economic participation" and "education," however, score above average in Warsaw.

Table 6.4 Total sustainability and capital scores for Prague and Warsaw

City	Total score	Ecological score	Socio-cultural score	Economic score
Prague	54.9	47.9	57.2	59.6
Warsaw	49.7	46.7	49.1	53.2

Overall, Prague scored higher than Warsaw, as shown in Table 6.4, and at a similar level to Berlin. Warsaw's score compares with the scores of Budapest and Madrid. In both Prague and Warsaw, the economic capital scores were higher than the two other sustainability capital scores.

6.7 Athens, Bucharest and Sofia

Athens (0.66 m), Bucharest (1.9 m) and Sofia (1.2 m) are capital cities in the southeast region of the EU, where several sustainability problems can be found. Table 6.5 illustrates that of the three, Sofia is coping most favorably with the challenges at hand.

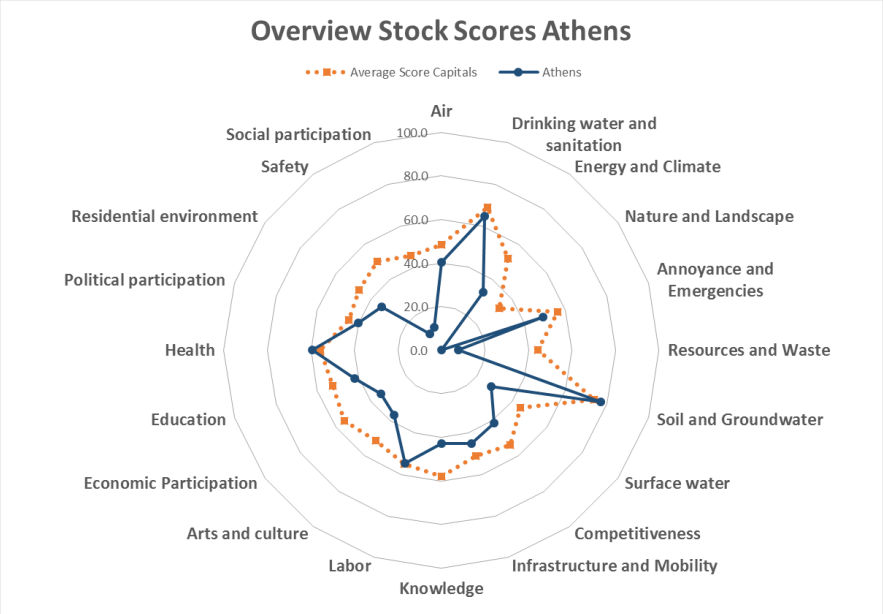
Table 6.5 Total sustainability and capital scores for Athens, Bucharest and Sofia

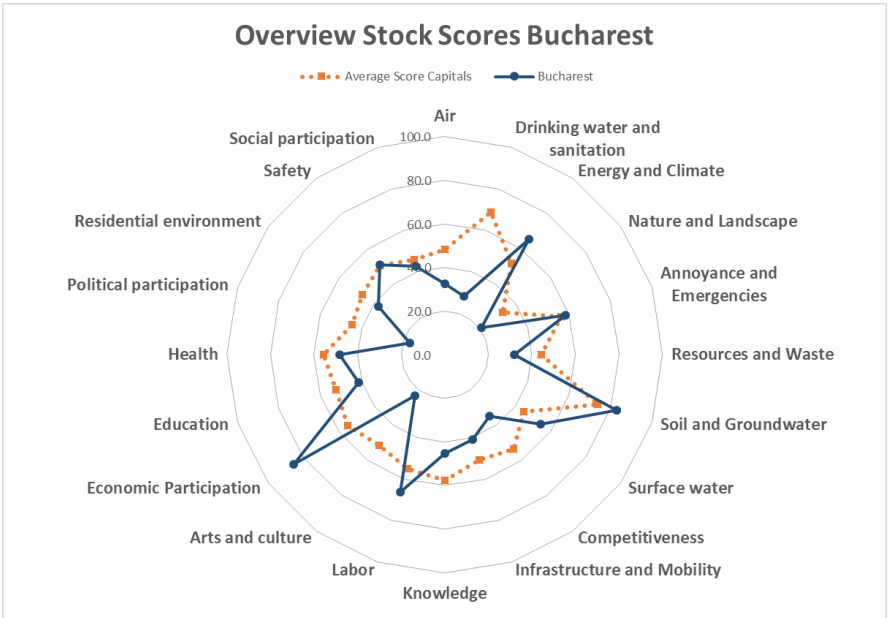
City	Total score	Ecological score	Socio-cultural score	Economic score
Athens	39.0	37.5	33.3	46.0
Bucharest	45.7	46.8	43.3	46.8
Sofia	47.7	55.4	39.3	48.4

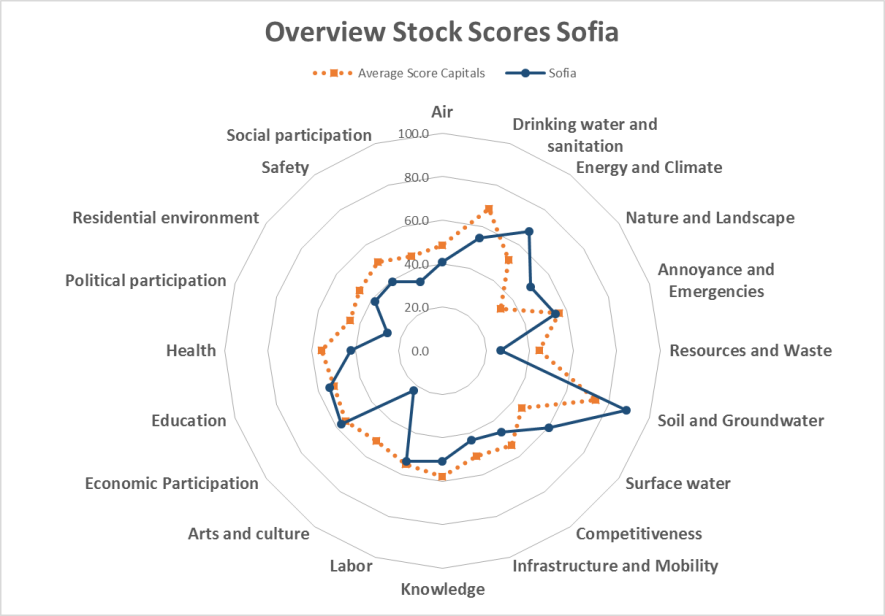
Athens has a somewhat lower total score than Rome, which is primarily due to its low sociocultural capital score. Bucharest has balanced sustainability capital scores, while Sofia, like Athens, must cope with a relatively unfavorable sociocultural situation. Sofia has the best scores in ecological capital.

At stock level, all three cities generally score below average. Favorable exceptions are found in Sofia for several ecological stocks, although waste handling lags behind, which is also the case for "arts and culture." The greatest challenges for

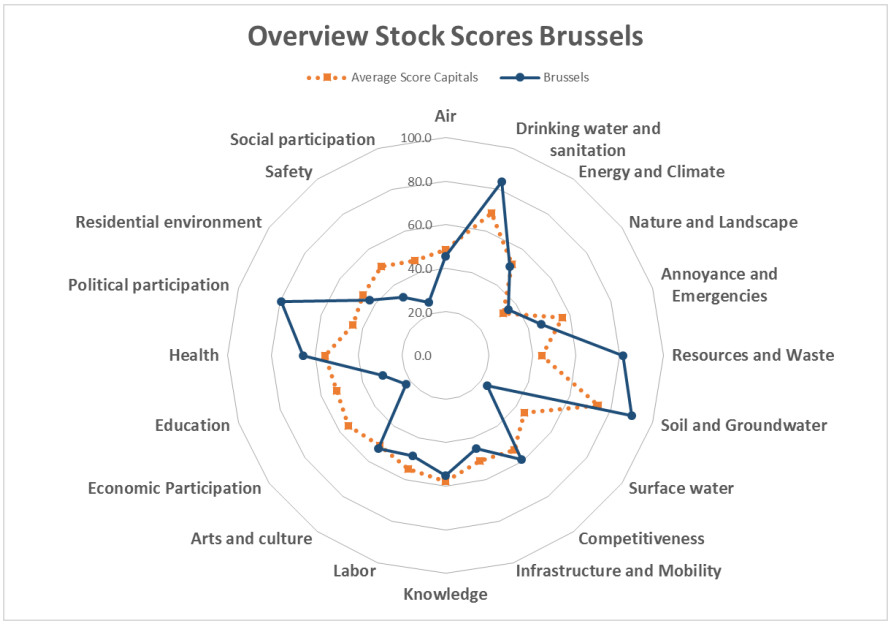
Athens are found for “resources and waste”, “nature and landscape,” “safety” and “social participation.” In Bucharest, the lowest stock scores are for “drinking water and sanitation,” “competitiveness,” “arts and culture” and “political participation.” However, Bucharest also has some high-scoring stocks, including “energy and climate” and “economic participation.”







6.8 Amsterdam, Brussels and Copenhagen


Overview Stock Scores Brussels
Average Score Capitals
Brussels
Air
Drinking water and sanitation
Energy and Climate
Nature and Landscape
Annoyance and Emergencies
Resources and Waste
Soil and Groundwater
Surface water
Competitiveness
Infrastructure and Mobility
Knowledge
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Arts and culture
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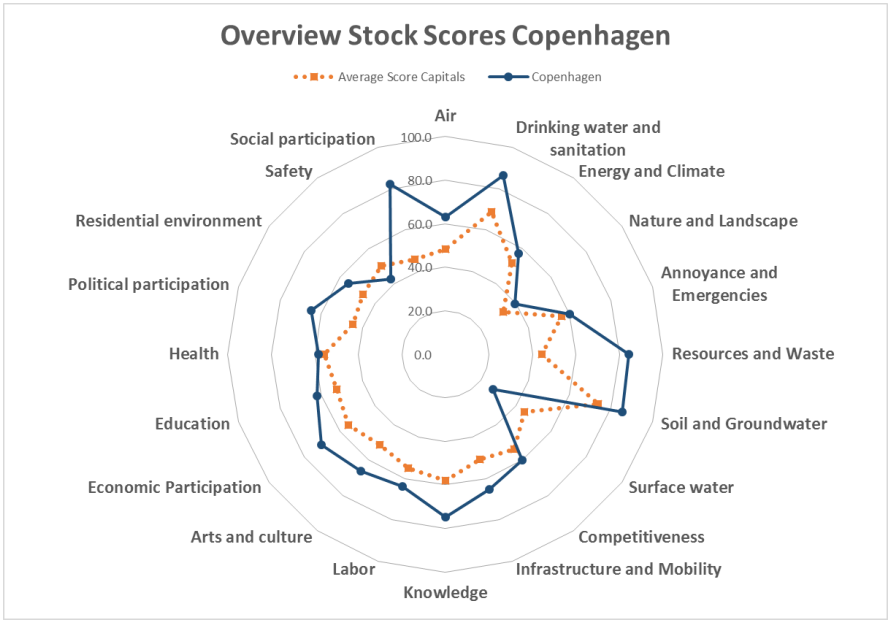
Overview Stock Scores Copenhagen
Average Score Capitals
Copenhagen
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Drinking water and sanitation
Energy and Climate
Nature and Landscape
Annoyance and Emergencies
Resources and Waste
Soil and Groundwater
Surface water
Competitiveness
Infrastructure and Mobility
Knowledge
Labor
Arts and culture
Economic Participation
Education
Health
Political participation
Residential environment
Safety
Social participation
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In this cluster of Amsterdam (0.83 m), Brussels (1.1 m) and Copenhagen (0.58 m), Brussels deviates most. It is not a harbor city and it is the actual capital of the EU. Its sustainability profile is quite different from the other two cities. Amsterdam and Copenhagen follow a nearly perfect profile, with most stocks scoring above average. In Amsterdam only “soil and groundwater” scored below average and in Copenhagen this applies only to “surface water.” In Brussels, however, “surface water,” “economic participation,” “education,” “safety” and “social participation” all lag behind the average. Copenhagen is the highest scoring capital city in Europe on total sustainability.

Table 6.6 Total sustainability and capital scores for Amsterdam, Brussels and Copenhagen

City	Total score	Ecological score	Socio-cultural score	Economic score
Amsterdam	58.1	58.0	55.4	61.0
Brussels	51.1	57.1	44.0	52.0
Copenhagen	63.9	62.8	62.7	66.0

Table 6.6 shows that despite the similarity in profiles of Amsterdam and Copenhagen, the latter scores considerably better on total sustainability. This is the result of better scores for all three forms of sustainability capital. Brussels’ low score for sociocultural capital is striking, while “resources and waste” and “political participation” score high in Brussels.

6.9 Helsinki and Stockholm

Helsinki (0.63 m) and Stockholm (0.95 m) are located in the wealthy northern region of the EU. In line with this, their sustainability scores are generally above average and comparable to those of Copenhagen.

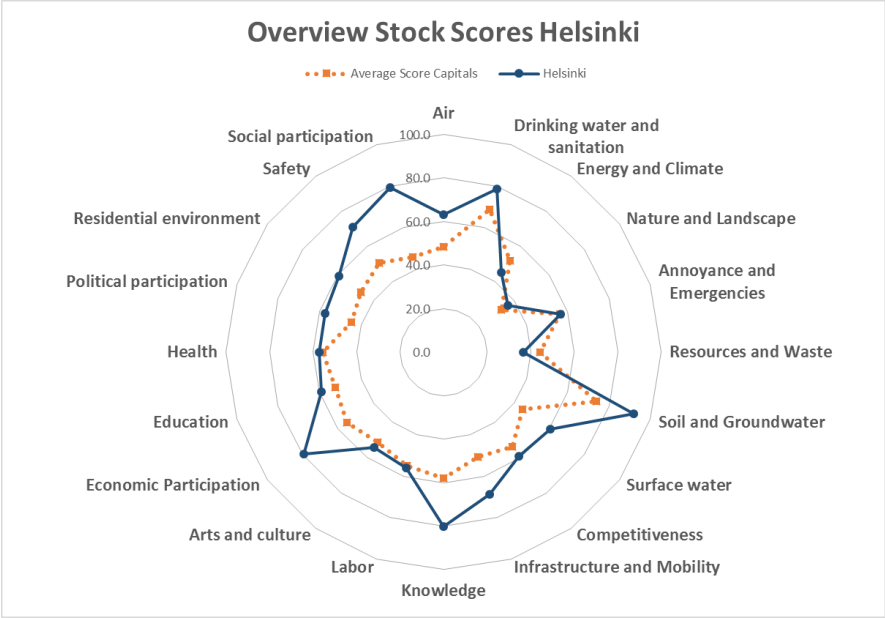
Table 6.7 Total sustainability and capital scores for Helsinki and Stockholm

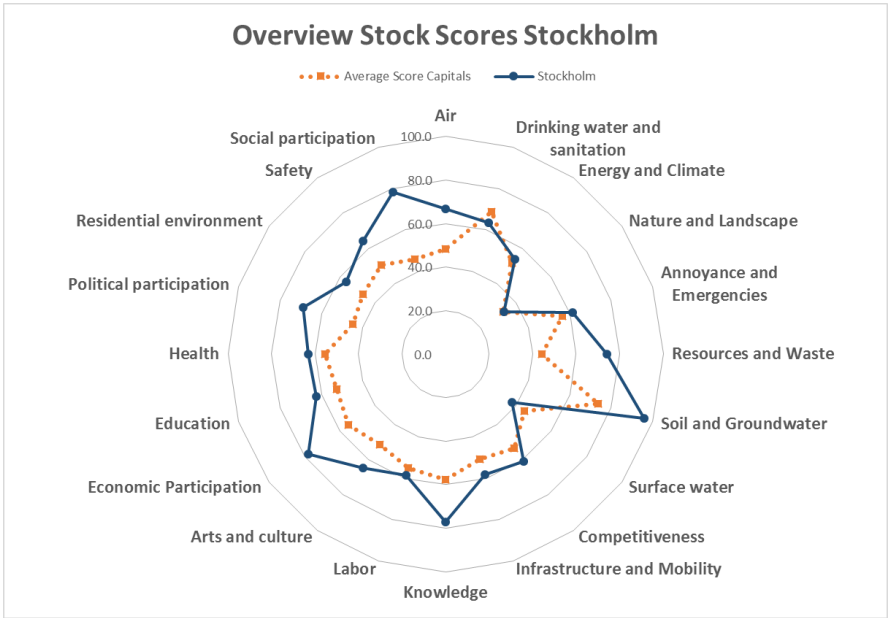
City	Total score	Ecological score	Socio-cultural score	Economic score
Helsinki	63.2	58.7	64.7	66.0
Stockholm	63.8	60.8	67.0	63.7

The Scandinavian capital cities not only have high economic scores, but also exceptionally high sociocultural scores, as shown in Table 6.7. Both Stockholm and Helsinki exceed the already high sociocultural scores of Copenhagen.

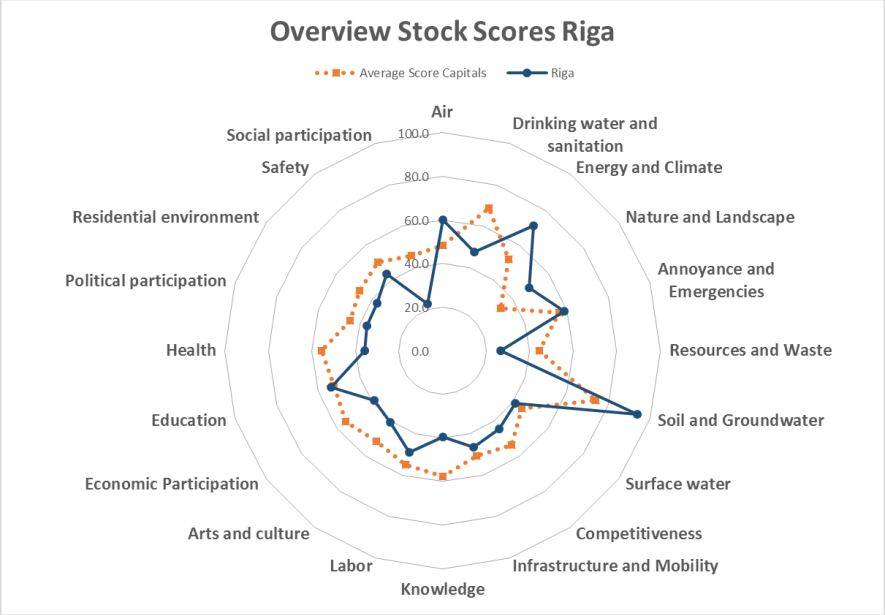
“Resources and waste” and “nature and landscape are the only stocks that score below average in Helsinki, while very high stock scores of over 80% are noted for “soil and groundwater,” “knowledge” and “economic and social participation.”

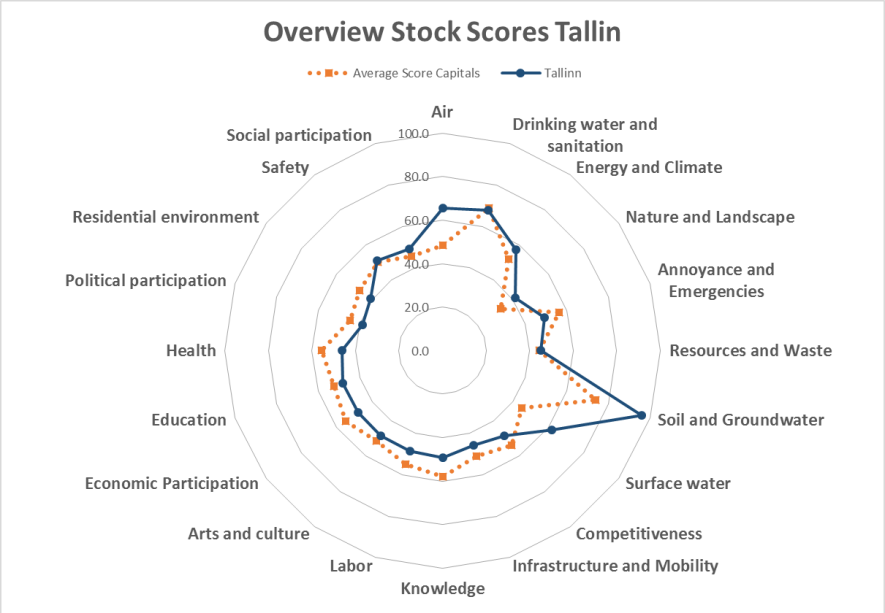
Stockholm is the second highest-scoring capital city of Europe, with only the “surface water” stock scoring slightly below average, while most other stocks score well above average, particularly the sociocultural stocks.

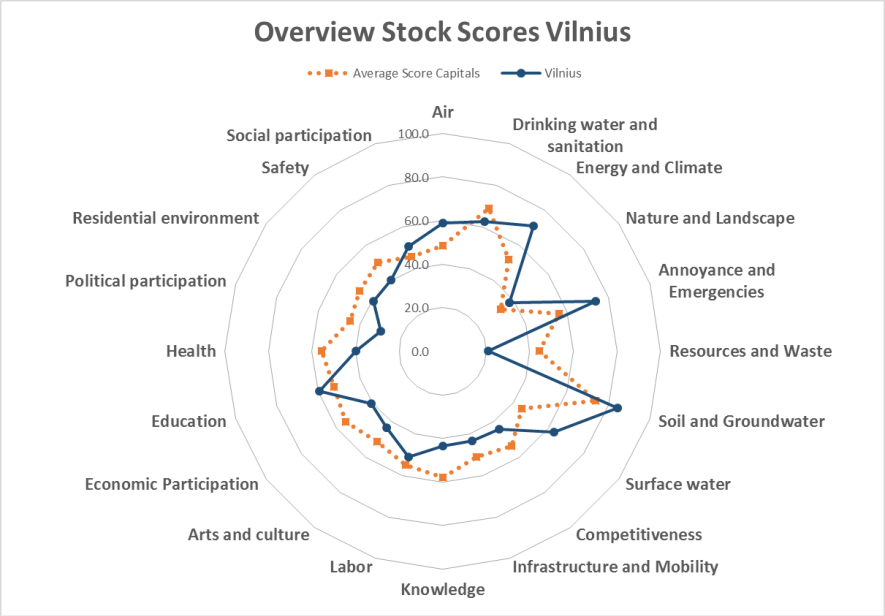




6.10 Riga, Tallinn and Vilnius







Riga (0.66 m), Tallinn (0.44 m) and Vilnius (0.54 m) have already been mentioned as important merchant cities along the coast of the Baltic Sea. They are relevant counterparts to Helsinki and Stockholm.

Table 6.8 Total sustainability and capital scores for Riga, Tallinn and Vilnius

City	Total score	Ecological score	Socio-cultural score	Economic score
Riga	46.5	56.1	38.6	44.8
Tallinn	51.6	60.6	46.3	47.9
Vilnius	49.2	59.2	42.8	45.5

As illustrated in Table 6.8, Tallinn has the highest total scores as well as the highest sustainability capital scores. Ecological capital performs best in these Baltic cities. Sociocultural capital is lowest in Riga.

A look at the spider diagrams indicates that Tallinn's profile almost fully matches the average. Riga outperforms the average for "air," "energy and climate," "nature and landscape" and "soil and groundwater," but economic and sociocultural stocks often score below average. Vilnius performs better than average for "air," "energy and climate," "annoyance by noise," "surface water" and "education," while "waste recycling," "knowledge," "economic and political participation" and "health" scored below average.

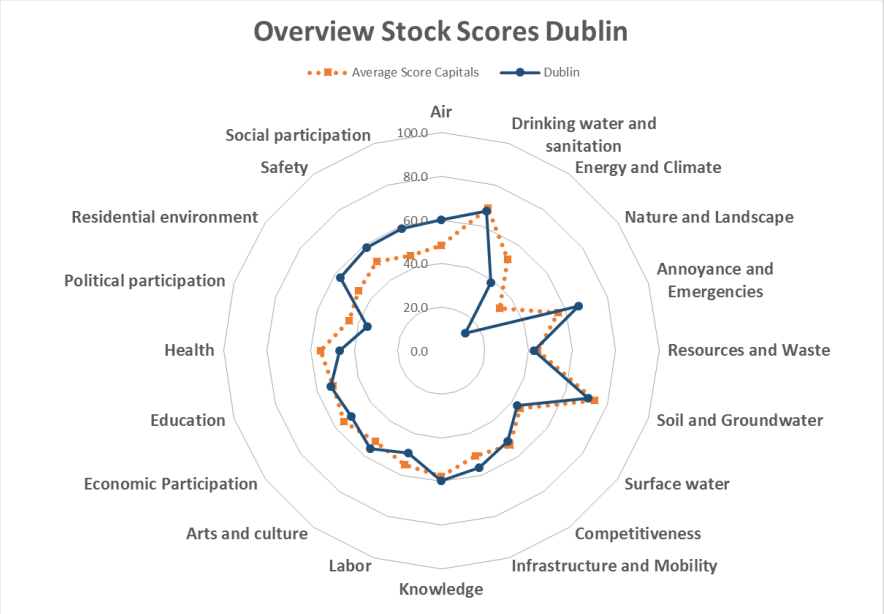
6.11 Dublin and Lisbon

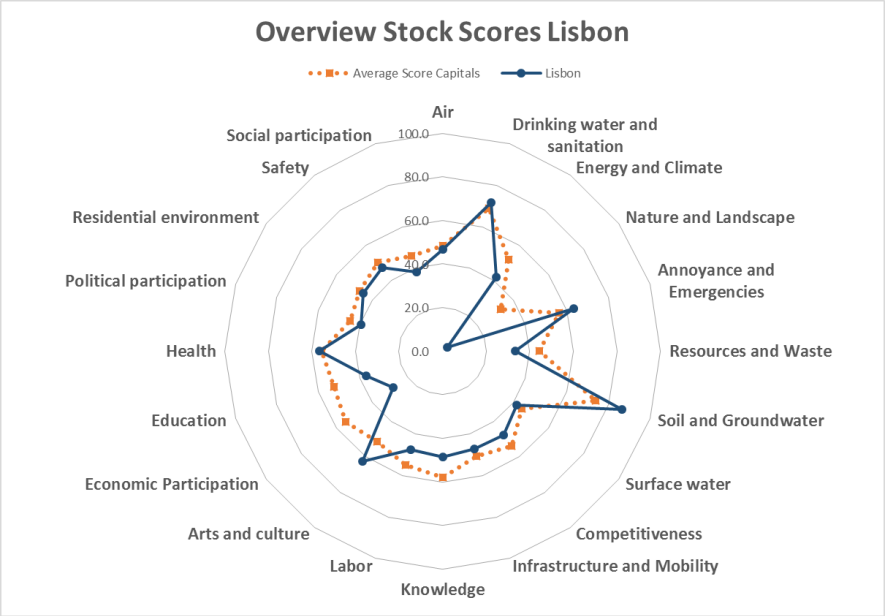
In this study, Dublin (0.53 m) and Lisbon (0.55 m) have been linked as two capital cities of the same size bordering the North Atlantic Ocean. Both cities generally reflect the average EU capital city profile except for their low scores on “nature and landscape.” Dublin, furthermore, has better than average scores for “residential environment,” “safety” and “social participation,” while Lisbon stands out in “arts and culture.” “Economic participation” and “education” are weaker points for Lisbon.

Table 6.9 Total sustainability and capital scores for Dublin and Lisbon

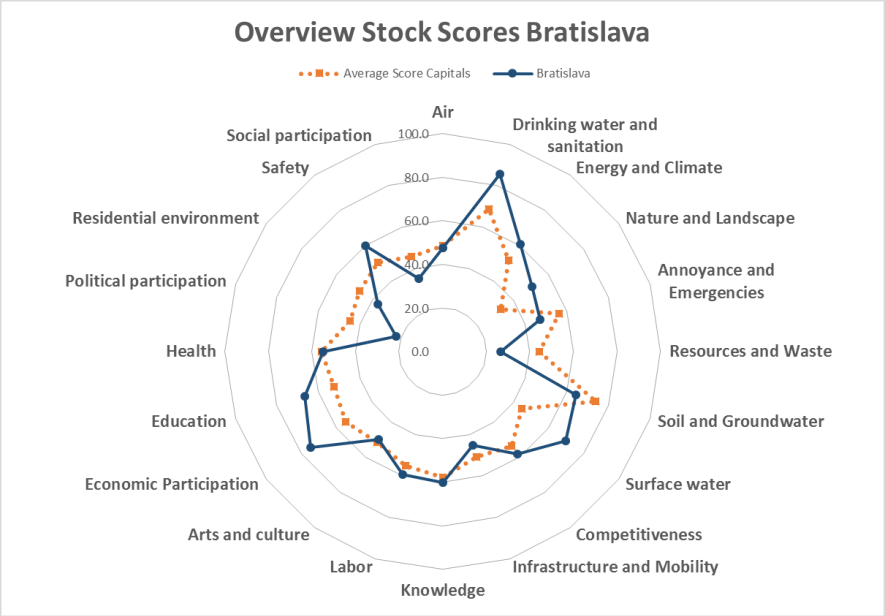
City	Total score	Ecological score	Socio-cultural score	Economic score
Dublin	52.2	50.2	52.1	54.3
Lisbon	46.8	48.5	44.2	47.7

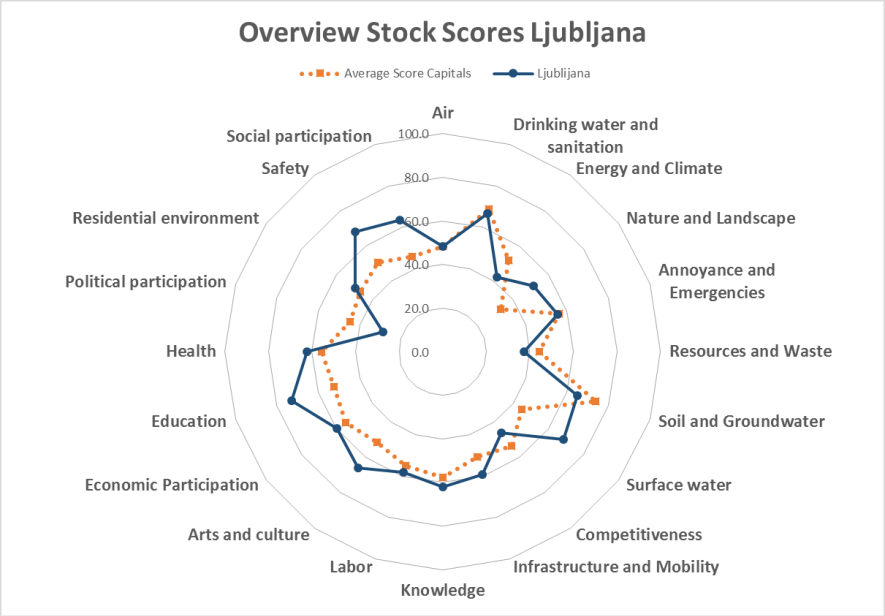
As Table 6.9 illustrates, Lisbon scored lower than Dublin for total sustainability and for each of the three forms of sustainability capital. The total score of Dublin matches the scores of Paris and Tallinn, while Lisbon’s total score lies between those of Madrid and Riga. The economic score is a strong point for Dublin, while Lisbon’s strongest point is its ecological quality.





6.12 Bratislava and Ljubljana





The sustainability stock profile of Bratislava (0.42 m) less resembles the average profile than that of Ljubljana (0.28 m). Ecological stocks generally score above average in Bratislava, with the exception of “waste handling,” while “political and social participation” are the only stocks that score below average. At the same time, Bratislava’s “economic participation,” “education,” and “residential environment” scores are well above average. Ljubljana’s profile reveals a score below average for “political participation,” but scores above average on “nature and landscape,” “surface water,” “education,” “safety” and “social participation.”

Table 6.10 Total sustainability and capital scores for Bratislava and Ljubljana

City	Total score	Ecological score	Socio-cultural score	Economic score
Bratislava	54.2	56.9	50.0	55.7
Ljubljana	56.6	54.4	58.9	56.4

As shown in Table 6.10, both cities have a total sustainability score of around 55%. In Bratislava, both ecological and economic capital contribute to this favorable score, while in Ljubljana the sociocultural score is the most outstanding.

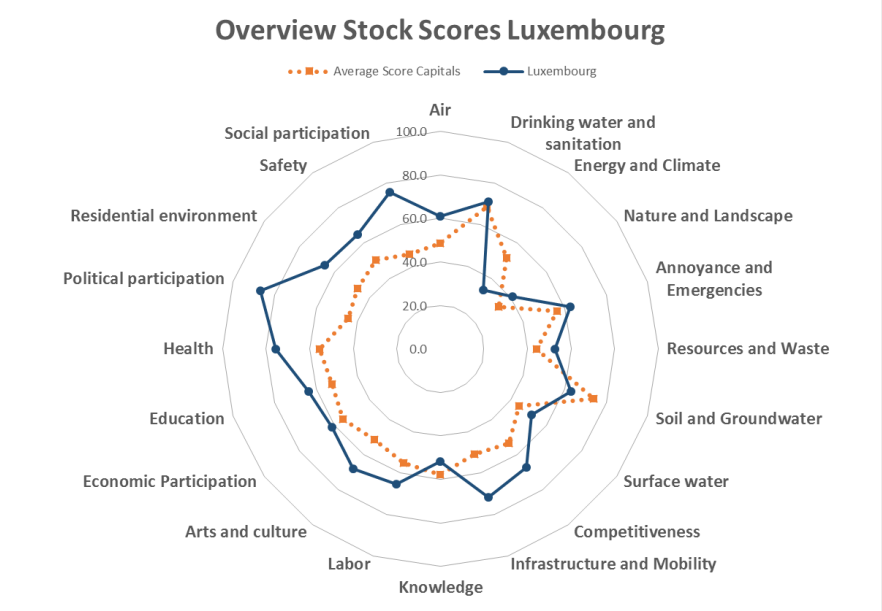
6.13 Luxembourg and Valletta

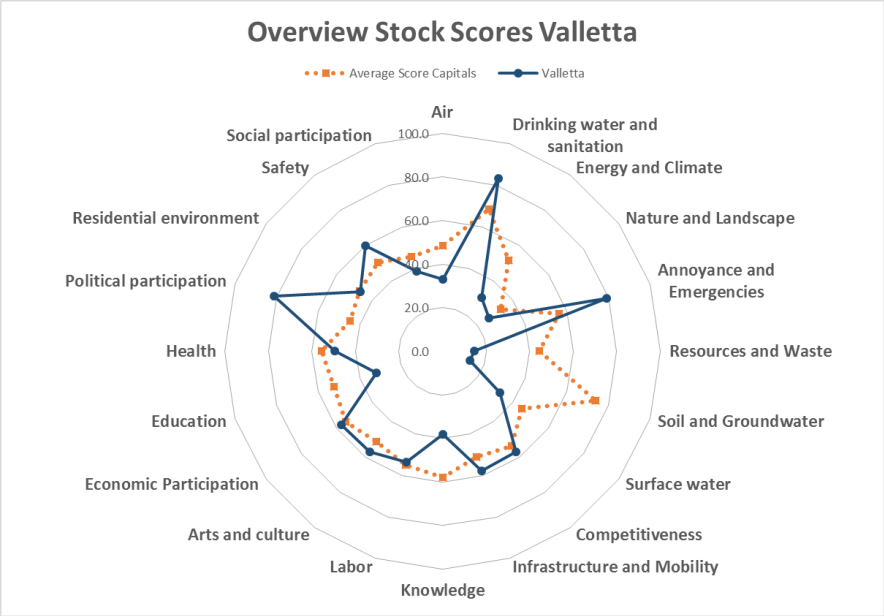
Luxembourg (0.09 m) and Valletta (0.20 m) are the two remaining, relatively small capital cities in this study.

Table 6.11 Total sustainability and capital scores for Luxembourg and Valletta

City	Total score	Ecological score	Socio-cultural score	Economic score
Luxembourg	62.9	54.5	70.3	64.1
Valletta	47.9	39.1	52.8	51.7

Luxembourg, surrounded by Belgium, France and Germany, shows a high total sustainability score similar to those of Scandinavian capital cities, and very high sociocultural and economic scores. Valletta, a small, historical, island capital in the Mediterranean Sea, compares with the total sustainability score of Lisbon, that is, below the score of Madrid but above those of Rome and Athens. The main point of concern for Valletta is its ecological capital and in particular “waste handling” and “soil and groundwater.”




Overview Stock Scores Valletta
Average Score Capitals
Valletta
Air
Drinking water and sanitation
Energy and Climate
Nature and Landscape
Annoyance and Emergencies
Resources and Waste
Soil and Groundwater
Surface water
Competitiveness
Infrastructure and Mobility
Knowledge
Labor
Arts and culture
Economic Participation
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Residential environment
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Social participation
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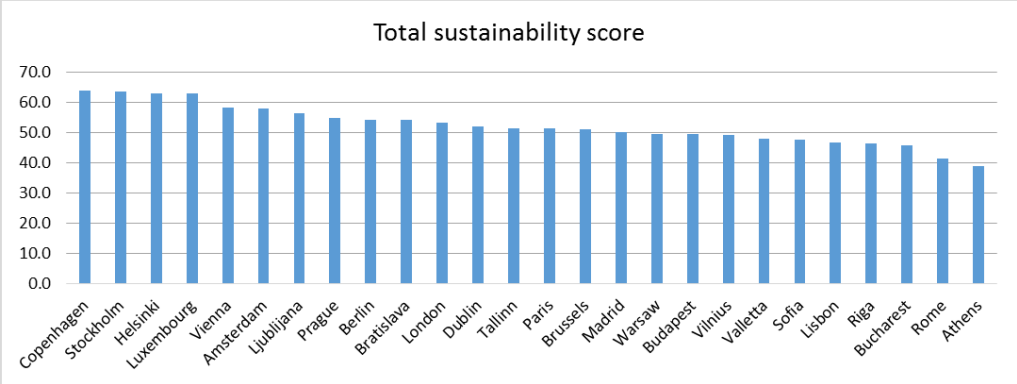
6.14 Summary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Ljubljana
Prague
Berlin
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London
Dublin
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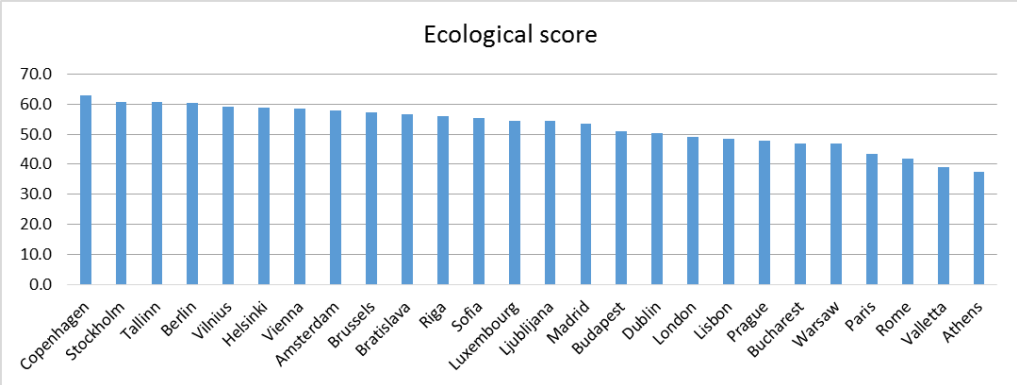
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Stockholm
Tallinn
Berlin
Vilnius
Helsinki
Vienna
Amsterdam
Brussels
Bratislava
Riga
Sofia
Luxembourg
Ljubljana
Madrid
Budapest
Dublin
London
Lisbon
Prague
Bucharest
Warsaw
Paris
Rome
Valletta
Athens

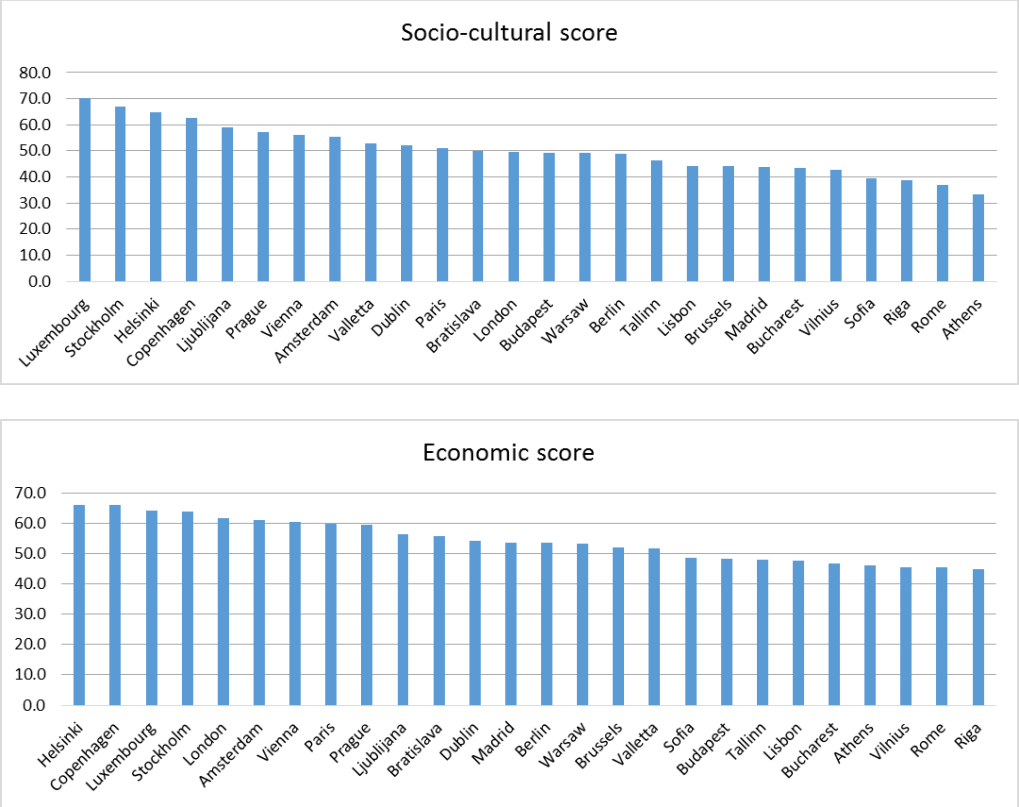

Figure 6.1 Overview of the total sustainability and capital scores of 26 EU capital cities

Figure 6.1 presents a summary overview of the 26 EU capital cities studied, in terms of total sustainability scores and each of the three sustainability capital scores. The largest variations occur in relation to sociocultural capital. Scandinavian capital cities and Luxembourg generally have the best of all three worlds.

Using the outcomes of the study presented here in the spider diagrams of stock scores, cities can identify their stronger and weaker points and subsequently determine whether these can be improved through local or regional policy initiatives or other means. Not all of the lower-scoring stocks may be changeable. Using these outcomes as a checklist of issues for potential sustainability improvements, authorities can select those which can be improved and which have the highest political priority from a local or regional point of view.

Based on the data collected, also other comparisons can be derived.

7 Explaining the sustainability performance of EU cities

This chapter will describe the effects of city size and geographic position on the sustainability scores of the EU cities studied. City typology, as developed by Telos, will also be briefly discussed. Finally, a selection of correlations among stocks and among indicators will be presented.

7.1 Impact of city demography on sustainability scores

Total sustainability scores rise slowly as city size increases from 40,000 to 2,000,000 inhabitants, as shown in Figure 7.1.

Figure 7.1 Sustainability scores of the 114 EU cities studied, ordered by city size

This trend towards improved performance in the overall score is the result of rather strong underlying dynamics concerning a rising economic capital score as city size increases, coupled with diminishing ecological and social capital scores for cities of 250,000 inhabitants or more. Surprisingly, all three forms of sustainability capital score lower on average in the group of cities with 40,000 to 100,000 inhabitants compared to the larger cities of 100,000-250,000. There are many reasons for this effect: for example, less capacity to organize urban infrastructure such as sewage collection and treatment, public transport or medical care facilities. A similar effect occurs at the other end of the scale: global cities of two million inhabitants or more show a large drop in value on all three capital scores compared to the XXLarge cities.[19] In these global cities, the general trend of economic capital performing better as city size increases no longer continues, and the ecological and social capital scores decrease considerably. It seems that an optimum in the economic performance of a city is reached at a size of one to two million inhabitants. It is important to better understand the reasons for this result in order to be able to design appropriate policies. Such policies should, of course, not consider the social processes in these cities in an abstract manner, but take into account the national welfare context as well. However, it should be noted that there are only six cities with a population above two million in Europe.

Another way to look at the impact of the demographics of cities on sustainability is to consider the relationship sustainability has with changes in population size over time. Figures 7.2 and 7.3 illustrate the sustainability performance of shrinking versus growing cities.

Figure 7.2 Sustainability scores for cities in the group of the 114 EU cities studied, ordered by changes in city size[20]

[19] A more detailed statistical analysis showed that the low economic capital score of small cities in comparison to the average score of the group of 114 cities studied was significant ($p<0.05$), as was the high economic capital score of the XXLarge cities compared to the total group's average score ($p<0.001$).

[20] Rapidly shrinking: decrease > 1%/5 years; slowly shrinking: decrease from 0.1-1%/5 years; slowly growing: increase 0.18-1%/5 years; rapidly growing: increase > 1%/5 years.

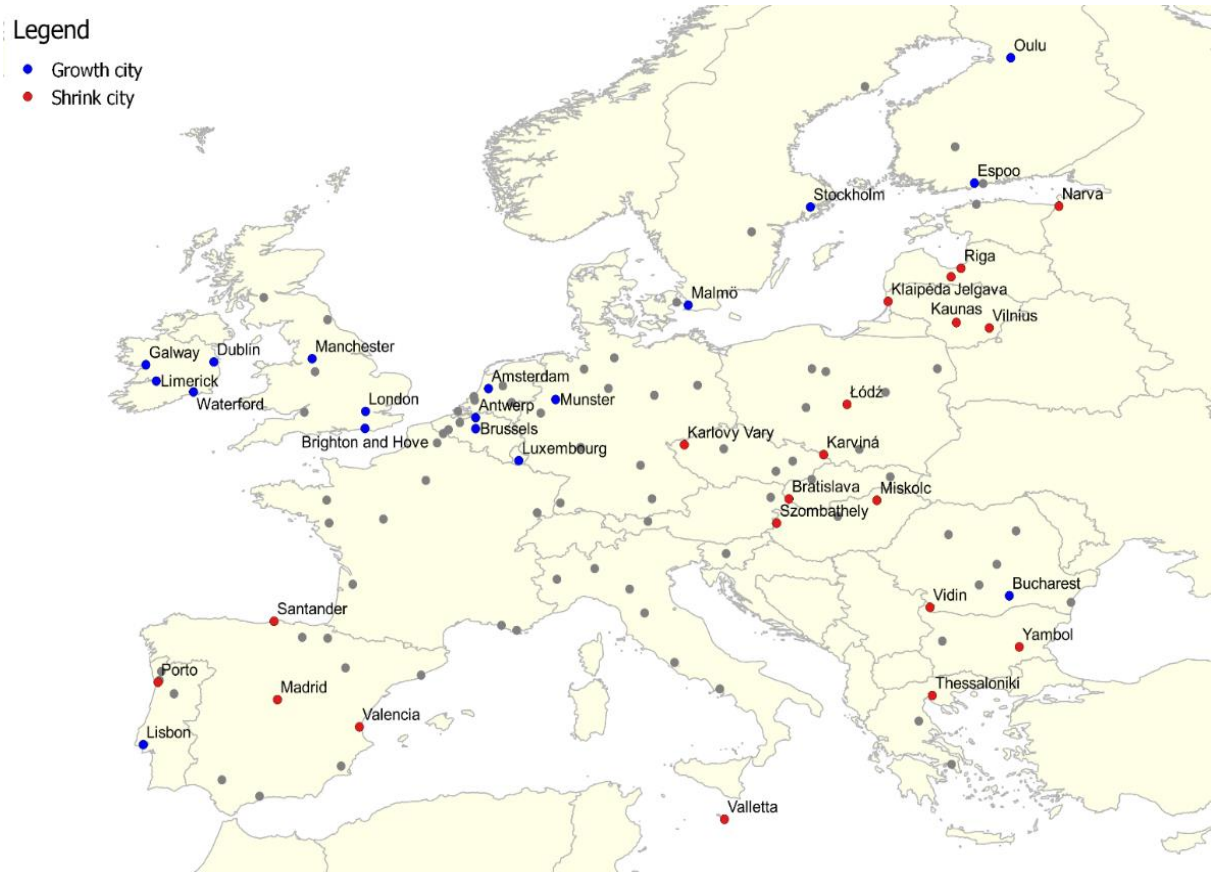

Figure 7.3 Map of growing and shrinking cities according to their typology defined in Table 7.1

As we move from rapidly shrinking to rapidly growing cities, sustainability steadily increases.[21] This also applies to the social and economic capital scores. Ecological capital scores are above average in the rapidly shrinking group of cities, decreasing in the neutral and slowly growing groups and following the general trend for the rapidly growing group. The differences between the capital scores become smaller as cities grow faster.

7.2 Impact of geographical position on sustainability score

To study the impact of the geographical position of nations and their cities, the nations have been divided into five regions, as shown in the map below.

[21] The impact on total sustainability significantly deviates (statistically) from average values for the rapidly shrinking and rapidly growing groups of cities.

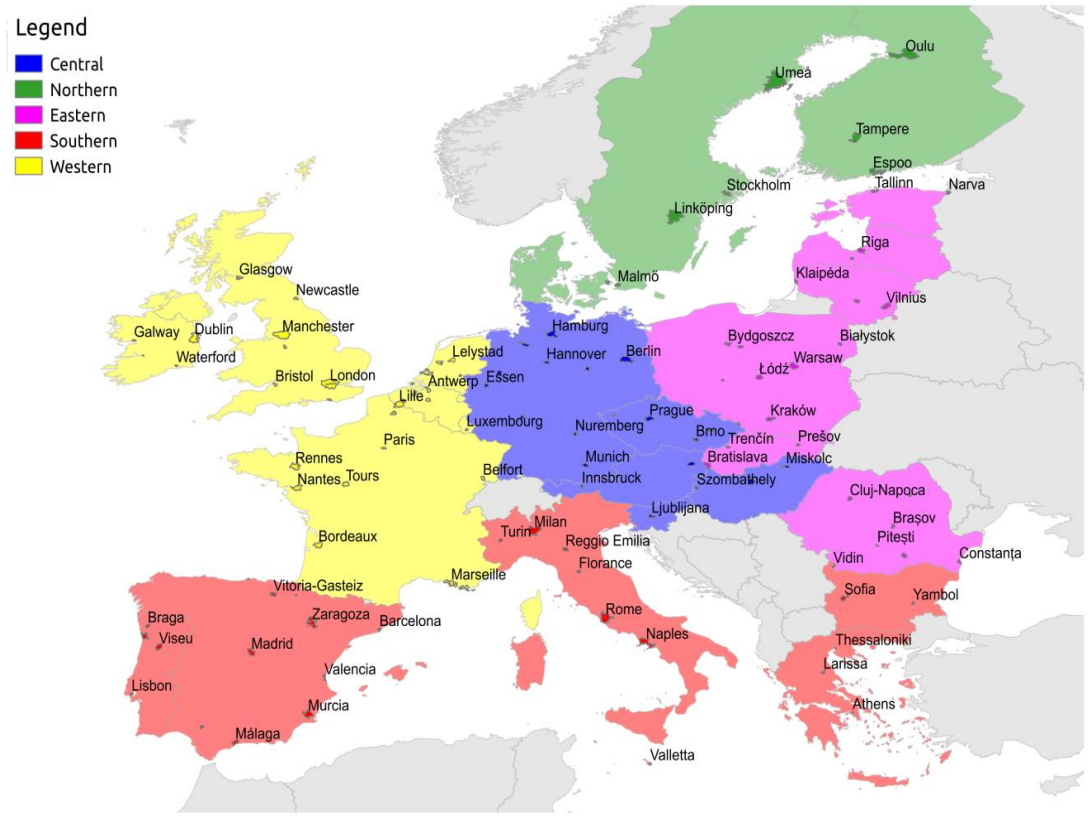

Figure 7.4 Map of five regions of member states

The regions (see Figure 7.4) show large differences in sustainability scores, as illustrated in Figure 7.5. The northern region (Denmark, Finland, Norway, Sweden) has by far the highest sustainability scores, with an average total score of 62.1%. All three forms of capital have the highest scores of all five regions. The cities in the central region (Austria, the Czech Republic, Germany, Hungary, Slovenia) score considerably lower on average than those in the northern region (54.0%), but still have relatively high ecological capital scores (average 56.9%). The cities in the western region (Belgium, Ireland, France, Luxembourg, the Netherlands, the UK) have a slightly lower average total sustainability score (52.5%) than the central cities, but somewhat better economic capital scores (53.3% versus 51.6%). The cities in the eastern region (Estonia, Latvia, Lithuania, Poland, Slovakia, Romania) have lower total sustainability scores on average (45.7%), which is due in particular to a rather low economic capital average score (40.2%), as well as a lower sociocultural score (43.6%). The cities in the southern region (Bulgaria, Greece, Italy, Malta, Portugal, Spain) have a somewhat similar profile to those in the eastern region, although the economic capital score is a little better (42.9% versus 40.2%). However, ecological capital has a lower score (47.8% versus

53.4%). Overall, a northwest-southeast gradient in sustainability scores was detected.[22]

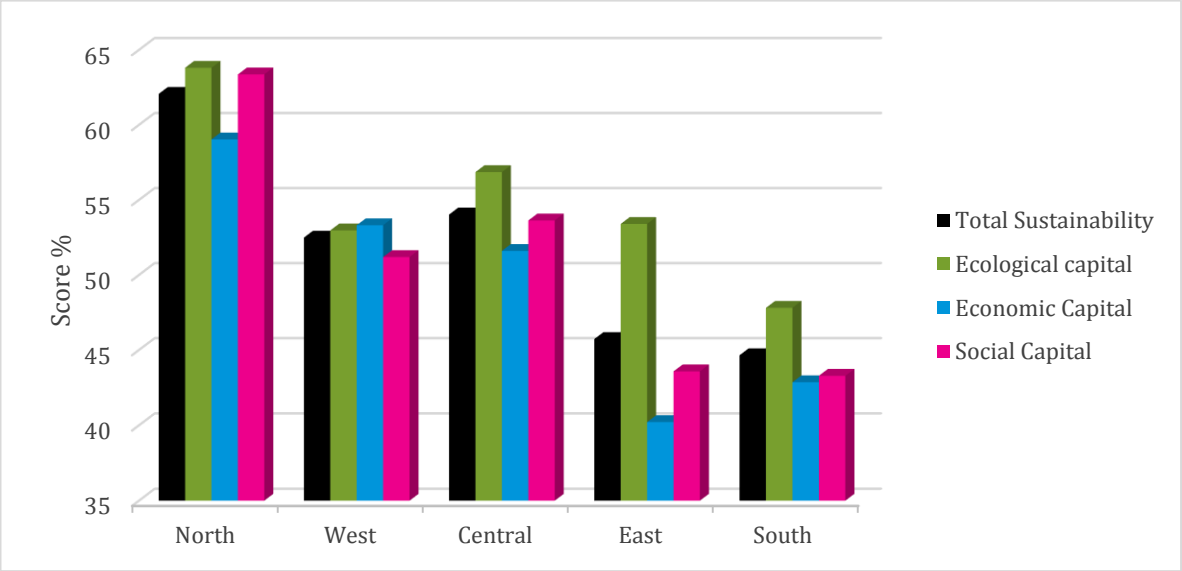

Figure 7.5 Sustainability score differences of 114 cities in 5 regions of the EU

Comparing the results from a regional point of view (see Figure 7.5) does not reveal the conventional polarity between ecological capital and economic capital. In this regional compilation, decreasing economic capital scores coincide, in general, with decreasing ecological capital scores. The similarity between ecological capital scores in the western and eastern regions of the EU, despite a strong differentiation in economic capital scores, is striking. Without further study it is difficult to explain the relatively high ecological capital scores in the east. It is possible that a lower level of economic development in the eastern region is the reason for the preservation of the natural environment, while greater wealth in the western region has resulted in a considerable restoration of environmental conditions. In the future, time series analysis will help explain these results.

Overall, the differences between the north and south are the largest, while the central and western regions are most alike. Such differences can, of course, not be explained purely in geographical terms, as geography coincides with other important factors of a historical, cultural and economic nature.

7.3 The role of city typology in benchmarking

One way to better understand sustainability dynamics in cities is to look at the sociogeographical characteristics of cities by grouping them into city types. The comparison of cities will be more meaningful when the benchmark is chosen with

[22] All the differences mentioned for total sustainability were statistically significant ($p<0.05$) in a test comparing the regional group average score with the total average score.

similar types of cities as a basis, rather than relying on the total group of cities studied.

In this study, a city type is defined on the basis of a generally recognizable sustainability feature of a group of cities that probably has far-reaching consequences for the scores on a number of sustainability indicators, such as historical pollution levels, large proportion of low-wage or high-wage jobs, the role of immigrants, the level of education, and the diversity of economic sectors.

The city typology presented here differs from existing typologies such as those of Eurostat (European Parliamentary Research Service, 2014) and ESPON (2013). Eurostat used city size as a basis for city typology, while ESPON has developed 8 major regional types at NUTS 3 level, based on combinations of spatial indicator values: (1) urban/metropolitan regions, (2) rural regions, (3) sparsely populated regions, (4) regions in industrial transition, (5) cross-border regions, (6) mountainous regions, (7) islands and (8) coastal regions. The EEA is currently developing a city typology that clusters cities on the basis of similar characteristics and then defines the typologies.

The typology proposed in this study is at this point not the result of a statistical analysis of the common characteristics of cities, but primarily based on select functional characteristics, which are likely to be related to a series of sustainability challenges for cities. The typologies were predefined on the basis of one characteristic, and the study was used to test whether this characteristic resulted in sustainability scores that significantly deviated from the average sustainability score. Thus, the typologies tested have a provisional status and will be further refined in future studies.

Below, a set of European city types is defined and discussed. Subsequently, the general position of the 114 cities studied is presented. Subsequently, the deviation of the scores of a certain type of city from the average scores of the total group of cities will be presented, revealing the impact of typology on sustainability scores.

7.3.1 Definitions for a Telos EU city typology

Table 7.1 presents a summary of nine types of EU cities, the defining criteria and the cities classified into a specific type.

The types of cities described in Table 7.1 include:

- Agricultural cities: most of the land surrounding them is used for agriculture
- Compact cities: characterized by a relatively high population density and service level
- Green cities: characterized by a high proportion of forested land within the city borders
- Growth cities: having experienced a significant population growth over the past 5 years
- Harbor cities: having a significant port area

- Resettlement cities: recently having a high expected inflow of refugees and asylum applicants
- Shrink cities: having experienced a decline in the total population over the past five years
- Tourist cities: having a high level of overnight stays by tourists
- Wealthy cities: showing a relatively high GDP per capita

Table 7.1 City typologies, their defining criteria, and cities classifying for these types

Typology	Criterion	Cities in typology
Agricultural City (n = 15)	The area of the municipality used for agricultural purposes is over 55%.	Florence, Galway, Hannover, Karviná, Lille, Lisbon, Madrid, Magdeburg, Middelburg, Szombathely, Turin, Tours, Vidin, Vilnius, Yambol
Compact city (n = 20)	The population density of the city is over 5,000 inhabitants per km^2	Arras, Athens, Barcelona, Belfort, Brussels, Bucharest, Copenhagen, Lisbon, London, Madrid, Milan, Naples, Pamplona, Paris, Porto, Santander, The Hague, Thessaloniki, Turin, Valencia
Green city (n = 21)	The forested area within the municipality is over 35%.	Innsbruck, Karlovy Vary, Oulu, Tampere, Belfort, Marseille, Toulon, Freiburg, Espoo, Miskolc, Madrid, Braga, Valongo, Viseu, Brașov, Piatra Neamț, Trenčín, Ljubljana, Zaragoza, Linköping, Umeå
Growth city (n = 18)	The city has had an average population growth of at least 1.3% per year over the past 5 years.	Amsterdam, Antwerp, Brighton and Hove, Brussels, Bucharest, Dublin, Espoo, Galway, Limerick, Lisbon, London, Luxembourg, Malmö, Manchester, Munster, Oulu, Stockholm, Waterford
Harbor city (n = 24)	The area of ports within the municipality is over 1%.	Amsterdam, Antwerp, Arras, Barcelona, Belfort, Bremen, Bristol, Constanța, Copenhagen, Ghent, Hamburg, Helsinki, Klaipėda, Lisbon, Magdeburg, Malmö, Rotterdam, Santander, Seville, Tallinn, Thessaloniki, Toulon, Valencia, Valletta

Resettlement city (n = 21)	The city has an estimated influx[23] of more than 10 refugees per 1,000 inhabitants (Jan-Jun 2015) or the city has more than 6 asylum applicants per 1,000 inhabitants (Jan-Oct 2015)[24]	Amsterdam, Berlin, Brussels, Budapest, Espoo, Frankfurt, Hannover, Helsinki, Innsbruck, Linköping, Malmö, Miskolc, Munich, Nuremberg, Paris, Rotterdam, Stockholm, The Hague, Umeå, Valletta, Vienna
Shrink city (n = 20)	The city has had an average population decline of at least 0.5% per year over the past 5 years.	Bratislava, Jelgava, Karlovy Vary, Karviná, Kaunas, Klaipėda, Łódź, Madrid, Miskolc, Narva, Porto, Riga, Santander, Szombathely, Thessaloniki, Valencia, Valletta, Vidin, Vilnius, Yambol
Tourist city (n = 20)	The NUTS 2 region of the city has had more than 7,000 overnight stays per 1,000 inhabitants by tourists.	Amsterdam, Barcelona, Berlin, Copenhagen, Florence, Frankfurt, Innsbruck, Karlovy Vary, Lisbon, London, Luxembourg, Middelburg,

[23] Because currently city-level data available on refugee numbers and asylum seekers on a European scale are lacking, the city-level immigration had to be estimated based on available data sources. In prior research, much evidence was found to prove that network externality effects influence the asylum destination choice (e.g. Neumayer, 2004; Moore and Shellman, 2007). Moore and Shellman (2007), for example, concluded that "Refugees flee violence, and their destination choice is overwhelmingly near-by, where others like them have gone in the past." Here, the estimated influx is determined by the latest available data on overall numbers of first-time asylum applicants per country (Jan-Jun 2015, UNHCR) and the overall number of refugees per country (Jan-Oct 2015, Eurostat), and these values are attributed to the cities according to the number of non-EU nationals per country and city (Eurostat). The calculation for the resettlement city typology as presented below gives an indication of the future distribution of refugees among European cities. It neglects the present involuntary location of refugees in relief centers. The complete formula is as follows:

Resettlement city if:	$\frac{Refugees\ (country)}{Inhabitants\ (country) \div 1000} \times \frac{Non-EU\ foreigners\ (city)}{Non-EU\ foreigners\ (country)}$	> 10
Resettlement city if:	$\frac{Asylum\ seekers\ (country)}{Inhabitants\ (country) \div 1000} \times \frac{Non-EU\ foreigners\ (city)}{Non-EU\ foreigners\ (country)}$	> 6

[24] In order to test the internal validity of the newly formed 'resettlement city' typology, an independent sample T-test was conducted to compare the level of non-EU nationals per city in resettlement cities and non-resettlement cities. There was no significant difference in the scores for resettlement (M = 7.92; SD = 4.02) and non-resettlement (M = 7.25; SD = 12.5) cities (t(98) = -0.234, p = 0.816). These results suggest that the method developed to estimate the level of asylum seekers and refugees per city is not biased by the level of non-EU nationals per city. Secondly, the regression analysis of the impact of typologies on the sustainability scores was conducted with the level of non-EU nationals both included and excluded in the equation. The results show that the relationship between the resettlement city typology and the sustainability scores is not distorted by the presence of the non-EU nationals variable. Therefore, the outcome of the resettlement city typology analysis is not confounded by the level of non-EU nationals.

		Munich, Paris, Prague, Rome, Stockholm, Toulon, Valletta, Vienna
Wealthy city (n = 20)	The NUTS 3 region of the city has a GDP (in PPS) larger than €40,000 per inhabitant	Amsterdam, Bratislava, Bremen, Brussels, Copenhagen, Dublin, Essen, Frankfurt, Hamburg, London, Luxembourg, Milan, Munich, Munster, Nuremberg, Paris, Prague, Stockholm, Vienna, Warsaw

Table 7.2 presents the average sustainability scores for the nine city typologies. The values reveal the deviation from the average score for the total group of cities and the statistical significance of this deviation.

Table 7.2 Overview of sustainability scores (deviation from average score and its statistical significance) for nine types of cities based on 114 EU cities

City type[o]	Total Sustainability		Ecological Capital		Socio-cultural capital		Economic capital	
(Constant)	47.92	***	51.26	***	47.53	***	44.97	***
Wealthy city	6.03	***	4.65	**	6.01	*	7.43	***
Resettlement city	5.57	***	4.83	**	5.45	**	6.42	***
Growth City	3.03	*	2.44		3.16		3.49	
Green city	2.82	*	6.29	***	2.39		-0.21	
Harbor city	2.01		2.30		0.82		2.90	
Agricultural city	1.07		2.27		0.11		0.82	
tourist city	0.18		-3.37	*	1.14		2.78	
Compact City	-3.59	**	-6.64	***	-4.22	*	0.09	
Shrink city	-3.66	**	-0.11		-5.38	*	-5.48	**

*p < 0.05; **p < 0.01; ***p < 0.001; [o] the expected sustainability score of a city type can be calculated by adding the constant value and the figure listed behind the city type: e.g., for the wealthy city type, the expected sustainability score for total sustainability is 47.89 + 5.82 = 53.71.

Table 7.2 lists city types ordered from high to low scoring on total sustainability. Wealthy cities (+6.03%) and resettlement cities (+5.57%) score significantly above average, while shrink cities (-3.66%) score significantly below average. One of the most striking results is that resettlement cities belong ecologically, socially and economically to the best performing cities of the EU. Refugees appear to be aware of such conditions.

Furthermore, growth cities and shrink cities are not only demographically extreme opposites but are also opposites from a sustainability point of view, as was presented in Figure 7.2. Ecological capital scores are significantly above average in green cities and below average in compact cities. The latter contradicts the hypothesis that a compact city can better organize its infrastructure and thus prevent environmental stress. The advantage of compact cities probably extends outside the city limits, as compactness prevents urban sprawl.

Another indication from this overview is that tourism is associated with lower scores on ecological capital, while the idea that it provides an impulse for economic development could not be statistically confirmed in this study. Finally, it is striking that harbor cities and agricultural cities do not have significant deviations from the average scores for the three forms of sustainability capital.

7.4 Comparing typology profiles of some EU capital cities

Typology profiles are helpful in understanding differences between cities. To further illustrate this, some examples of several large capital cities will be provided below.

7.4.1 Typology profiles of Berlin, London and Paris

Figure 7.6 shows differences and commonalities between the typology profiles of Berlin, London and Paris. All three cities score high on wealth and tourism. Only London is clearly a growing city but has at the same time a very low score as a resettlement city. Paris is the most compact city, while Berlin is the least compact of the three. Being a wealthy city is linked with high economic capital scores in all three cities, London and Paris in particular (see also Section 6.3). Paris, the most compact city of the three, also has the lowest ecological capital score.

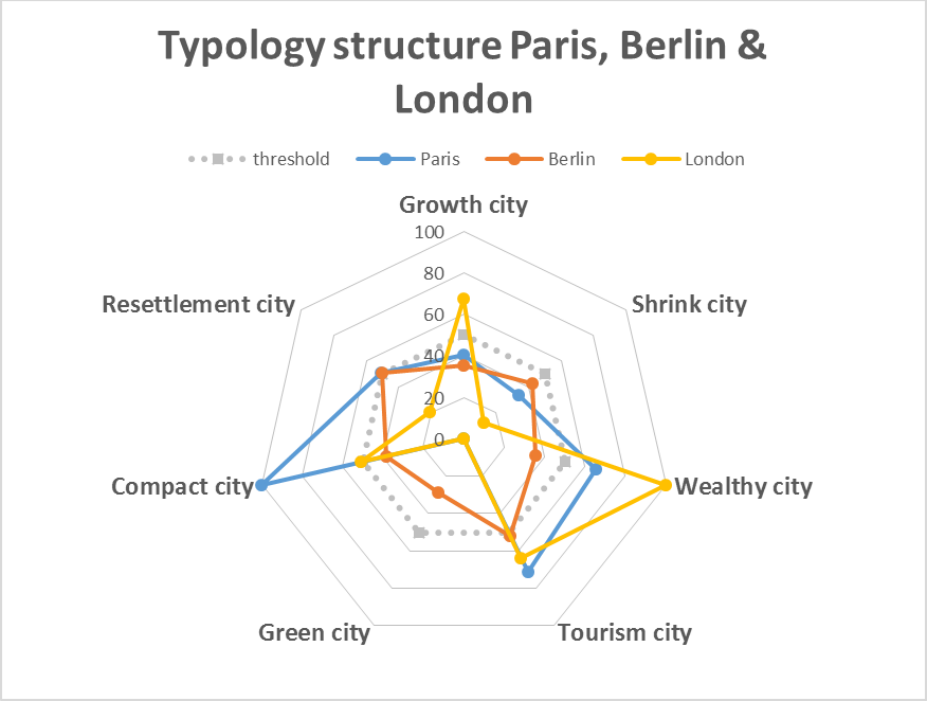

Figure 7.6 Typology profiles of Berlin, London and Paris

7.4.2 Typology profiles of Madrid and Rome

The typology profiles of Madrid and Rome reveal many resemblances: both have an outstandingly high score on wealth, and very low scores on the resettlement

city type (Figure 7.7). Madrid has higher scores than Rome for the green city and compact city types. Rome scores higher on the tourism city type. A comparison with the sustainability score profiles described in Section 6.4 reveals that it is the green city typology of Madrid which explains its higher ecological capital score.

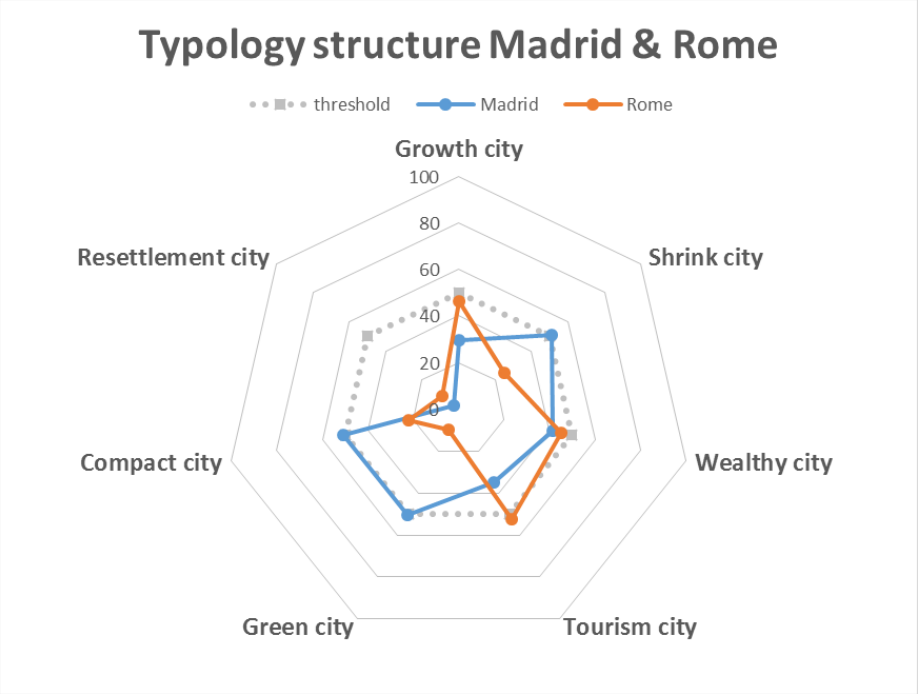

Figure 7.7 Typology profiles of Madrid and Rome

7.4.3 Typology profiles of Budapest and Vienna

As in the cases of Madrid and Rome, the typology profiles of Budapest and Vienna show many mutual resemblances (Figure 7.8). The outstanding city type in both cases is the resettlement city. Vienna scores somewhat higher as a tourism city. The sustainability profiles of both cities (see Section 6.5) show better scores for Vienna. Budapest, however, attracts more refugees.

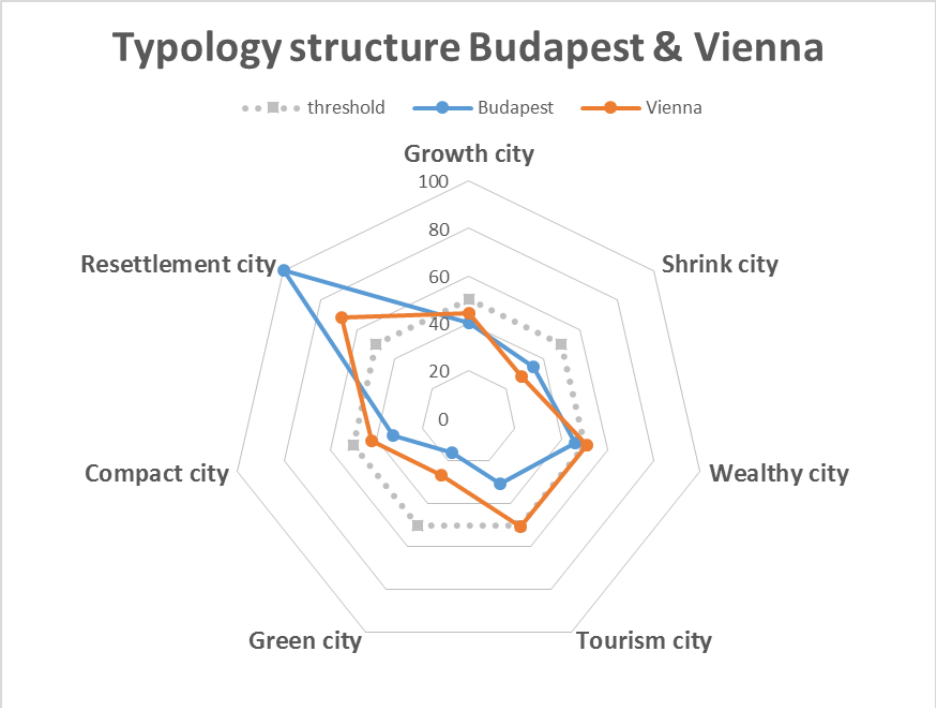

Figure 7.8 Typology profiles of Budapest and Vienna

These typology profile comparisons show that in individual cases it is not always clear which individual city will perform best on sustainability. However, Table 7.2 illustrates that typology is an important factor in understanding general trends in urban sustainability.

7.5 Correlations between sustainability stock scores and individual indicator scores

A wide variety of data on statistical correlations between stock scores and individual indicator scores is available. This report will only highlight some of the most striking results.

7.5.1 Stock factors most strongly correlated with total sustainability

The concept of sustainable development presupposes that the three forms of sustainability capital are interrelated. The present study can help to substantiate interrelationships. An overview of the Pearson correlation coefficients between stock scores for the 114 EU cities studied is given in Annex 6. The strongest factors impacting on other stocks and, thus, on sustainability in general, are discussed here.

Competitiveness

The economic stock of “competitiveness” was found to be the most important indicator of sustainability performance as it correlated significantly with nine other stock scores. These include two other economic stocks (“infrastructure and mobility” and “knowledge”), two ecological stocks (“drinking water and sanitation” and “resources and waste”) and five sociocultural stocks (“arts and culture,” “economic participation,” “education,” “health” and “political participation”). Competitive cities obviously do not only invest in a good traffic infrastructure, but also in good drinking water and sanitation infrastructure and a waste recycling system, as well as in education and health care infrastructure. Competitiveness thus appears to be a key stock for sustainable development.

Knowledge

A second key stock for sustainable development is undoubtedly “knowledge.” It significantly correlates with eight other stock scores, including all economic stocks, the “resources and waste” ecological stock and four sociocultural stocks (“arts and culture,” “economic participation,” “education” and “health”).

Resources and waste handling, infrastructure and mobility, and health

After “competiveness” and “knowledge,” the stocks of “infrastructure and mobility,” “resources and waste,” and “health” are the next most significant, with each correlating with seven other stocks. Waste handling has become by far the most indicative ecological stock for the broader issue of sustainable development. “Energy and climate,” currently the most intensely discussed subject in environmental politics, only correlates strongly with “political participation,” while “waste handling” correlates with “drinking water and sanitation,” “competitiveness,” “infrastructure and mobility,” “knowledge,” “economic participation,” “health” and “political participation.”

The stock of “infrastructure and mobility” correlates very strongly with “competitiveness” and therefore follows more or less the same correlation pattern discussed for “competitiveness.”

“Health” is correlated with “drinking water and sanitation,” “resources and waste,” “competitiveness,” “infrastructure,” “knowledge,” “arts and culture” and “political participation.”

This overview indicates that economic capital – particularly represented by competitiveness, knowledge and transport infrastructure – is the main driver of sustainable development. However, such development requires a well-organized society with committed citizens and a responsible and innovative business community.

7.5.2 Indicators responsible for competitiveness and correlating with other indicators

Many statistically significant correlations can be discussed at the level of individual indicators. However, in the context of this report this is not appropriate. Therefore one example will be presented, for the stock that was found to be most influential in relation to urban sustainability: competitiveness.

"Competitiveness" is composed of five indicators. Table 7.3 lists the number of significant correlations of the five competitiveness indicators with other indicators, classified according to the forms of capital of which they are part.

Table 7.3 Indicators correlating significantly[25] with competitiveness indicators

Capital to which indicators, correlating with competitiveness indicators, belong	Starting businesses	Ended businesses	Disposable income	Employment growth	Labor productivity	Total
Ecological	0	3	7	1	5	16
Sociocultural	3	6	9	3	9	30
Economic	0	1	9	0	7	17
Total	3	10	25	4	21	63

Table 7.3 shows that among the five "competitiveness" indicators, "disposable income" and "labor productivity" are strongly correlated and most frequently correlated with other indicators, not only within economic capital but also with approximately five to seven ecological indicators and nine socioeconomic indicators. Furthermore, "starting businesses" is less important in this respect than "ended businesses." Of the ecological indicators, "waste incineration" and "landfilling" are most frequently correlated with "competitiveness" indicators. For sociocultural capital, the indicator of "European and national election turnout" is most frequently correlated with "competitiveness."

7.6 Search for key indicators

To cover all aspects of sustainable development would require a proliferation of the number of indicators. However, collecting data for indicators is costly and therefore puts a limit to the number involved. Nevertheless, new ways of collecting data, the use of remote sensing for example, will probably create new opportunities in the future. Against this background it remains of interest to identify candidate indicators that can function as a reference for a larger group of indicators. The data available from this study may help to identify such reference indicators. As a detailed analysis of the data gathered would depart too much from the main subject of this study, only one example of such a reference indicator will be discussed here: labor productivity. This indicator has one of the highest numbers of significant correlations with other indicators (see Table 7.3). Figure 7.7 illustrates the relationship between labor productivity and sustainability scores.

[25] Pearson coefficient > 0.5, $p < 0.01$.

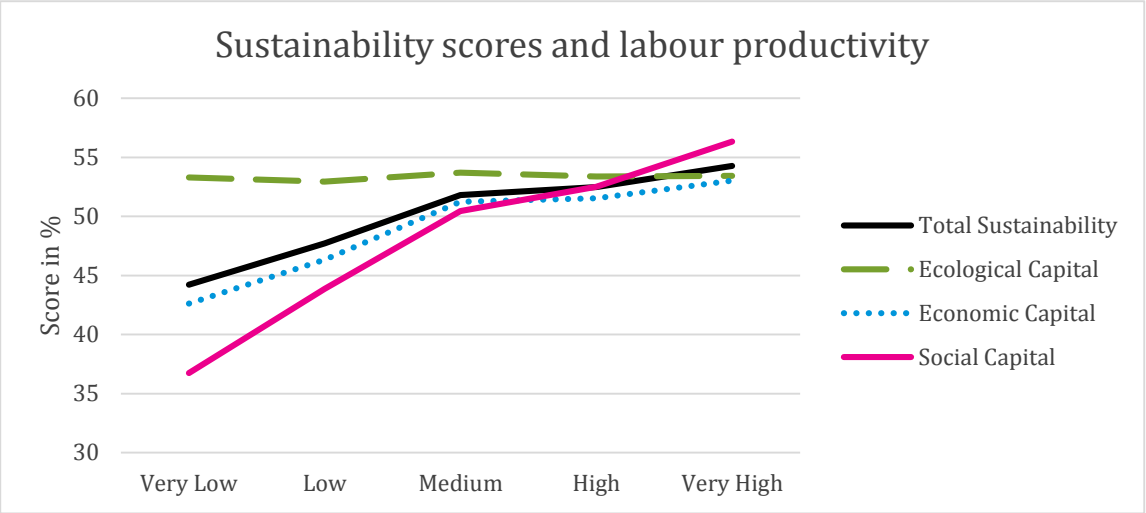

Figure 7.9 Relationship between labor productivity[26] and sustainability scores for 114 EU cities

Increasing labor productivity is associated with higher sustainability scores in the range of low productivity values to medium values. A kind of saturation of the effect seems to occur here, as higher labor productivity does not result in much higher sustainability scores. Labor productivity, although part of economic capital, is most strongly associated with sociocultural capital, and is not associated with ecological capital at all.

A more detailed analysis of the database may reveal other interesting reference indicators for urban sustainability, which may help to identify key factors in sustainable urban development.

[26] Very low: sustainability score < 25%, low: 25-42%, high: 50-60%, very high: > 60%.

8 Conclusions

In summary, this first study of the integrated sustainability performance of more than 100 major European cities has shown considerable differences between these cities. This contrasts with the group of 31 Dutch cities, which differ little from each other.

Below, the sustainability characteristics of the EU and Dutch cities will first be summarized. Subsequently, some of the factors that were found to be important to the sustainability performance of EU cities will be discussed, as well as the policy issues that are related to these results. Finally, recommendations, including a research agenda to clarify major issues detected in this study, will be formulated.

8.1 Sustainability scores of EU cities vary widely

The total sustainability scores of the cities studied show much variation, ranging from 35% to 65% (percentage achievement of the sustainability goal). The highest-scoring cities, with total sustainability scores above 60%, were mainly Scandinavian and German, including in descending order, Espoo, Copenhagen and Stockholm. The lowest scoring cities, with total scores below 40%, included Naples, Thessaloniki and Constanta, and nearly all of the cities in this group border the Mediterranean or the Black Sea.

The best ecological scores were found in several Scandinavian cities. The ecological top three scored above 65%. They were Umeå, Tampere and Linköping. The lowest ecological scores, of less than 40%, were found in Naples, Athens and Valletta.

In relation to sociocultural capital Luxembourg, Munich and Stockholm head the list, while the lowest scores were detected in Thessaloniki, Naples and Athens.

The trend in relation to economic capital is similar to the scores for the other two forms of capital. Cities in the northwestern region of Europe are overrepresented in the high-scoring group, which includes Helsinki, Copenhagen and Espoo, while the low-scoring group includes Constanta, Piatra Neamț and Pitești, all in the southeast.

The scores for all three forms of capital generally show higher or lower scores simultaneously in the cities concerned. Demographic, geographic and economic factors were analyzed as possible drivers of these results, as will be discussed below.

8.2 Relatively small differences between Dutch cities studied

The Dutch cities studied, the 31 largest cities in the country with a population of more than 100,000, on average score higher on all three forms of sustainability capital than the group of 114 EU cities studied. The average ecological capital score of Dutch cities deviates least from the EU average, while the mean economic capital value of the Dutch group deviates most, in a positive direction, from the EU group of 114 cities.
In a comparison with a selection of 20 EU cities of similar size and regional position around the North Sea Basin, it was found that only three cities outperform the best Dutch city: they were Linköping, Umeå and Nuremberg. Several UK cities score at the lower end of this group, while Amsterdam scores somewhat lower than Frankfurt, and Antwerp and Rotterdam had nearly identical scores. The differences between Dutch cities were found to be rather small, with scores ranging from 53.6% to 59.5%.

8.3 Factors and mechanisms influencing urban sustainability

The study revealed several factors that are statistically strongly related to sustainability performance. These include:

1. Population size
2. Demographic dynamics
3. Geographical position in the EU
4. City typology
5. Competitiveness
6. Knowledge
7. Resources and waste handling
8. Infrastructure and mobility
9. Health

8.3.1 Is there an optimum city size and how can this be influenced?

The overall sustainability score of EU cities improves for cities of with larger populations, up to cities of two million inhabitants. This is the result of rising economic capital scores for cities of larger size and, at the same time, diminishing ecological and social capital scores for cities above 250,000 inhabitants.

All three forms of sustainability capital score, on average, lower in the group of cities with 40,000 to 100,000 inhabitants. The improvement in both ecological and social capital between city sizes from 40,000 to 100,000 and the group of 100,000 to 250,000 inhabitants is remarkable. It appears that the rising economic capital scores in even larger cities cannot be translated into improved social and

ecological capital scores. In fact, in the range from 100,000 to 2,000,000, the total sustainability scores remain rather constant as the result of counter movements in the latter two forms of capital. At a size of 2,000,000, it seems that further growth no longer results in improved economic capital performance, while the reduction in the scores for the other two forms of capital increases. The end result is a sudden drop in the total sustainability score of the six global cities in Europe. Why does population growth over 2,000,000 no longer have a positive effect? Why are the traditional ways to improve economic performance no longer effective in very large cities? And how can the negative impact of growing economic capital on ecological and social capital be reversed? A more detailed study of the causes and possible remedial policy actions to overcome these processes is of great importance.

As suggested by these results, the dynamics in smaller cities of 100,000 inhabitants or less may be quite different from those in larger cities. Considering that a large proportion of the EU population lives in such smaller cities, it is recommended that this group also be further studied, although it is still rather difficult to collect reliable data on their sustainability performance.

8.3.2 Demographic change is an important but not always primary factor in predicting urban sustainability

It is not easy to derive the real reasons for sustainability performance levels from the generally available statistical data. One example is the parameter of rapid change in population size. This study has shown that shrinking or growing cities are in quite different positions from a sustainability point of view. At a certain size, the more a city grows, the better its sustainability performance. However, this does not mean that city growth itself is always the reason for a favorable sustainability performance. Other factors, more essential for understanding which dynamics are taking place, may be the root causes of both a shrinking or growing population and sustainability performance. Strong social and geopolitical tensions, for example, may cause people to move elsewhere, but these will not be visible in the sustainability capital scores.

8.3.3 Geographical position in the EU is a major factor in understanding sustainability performance

Geographical location is a dominant factor that predicts urban sustainability performance. The Scandinavian cities shine at the top of scoring lists, while cities in the southeast of Europe are confronted with major challenges to improve sustainability performance, both economically and socially. A better understanding of the primary drivers of improved sustainability scores in these varied conditions will be helpful in the creation of optimum strategies for the regions in Europe that need them most.

8.3.4 City typology is crucial for benchmarking

City typology was also found to be an important instrument in understanding urban sustainability dynamics. Growing and shrinking cities were discussed in Section 9.3.2. Table 7.2 has further shown that wealthy cities and green cities perform above average and compact cities below average, while harbor cities and

agricultural cities do not reveal significant deviations from the average scores for the three forms of sustainability capital. City typology is a major instrument that can help in the benchmarking of cities in a fair and constructive manner. Merely listing cities according to their sustainability scores does not provide helpful references for cities to judge their own performance and learn about possible new approaches to the challenges they face. Benchmarking between cities with a similar typology can help overcome these drawbacks.

8.3.5 Important policy areas to improve sustainability identified by most frequently correlated stocks

The concept of sustainable development presupposes that the three forms of sustainability capital and their constitutive stocks and indicators are interrelated. The present study has shown which stocks and indicators are of most interest in this respect. The stocks of “competitiveness,” “knowledge,” “resources and waste handling,” “infrastructure and mobility” and “health” are of particular importance. Further research is needed to better understand the association of these stocks’ scores with total sustainability performance in order to clarify which stocks and indicators are the primary drivers of improved sustainability performance, and how they can be influenced by policies at the municipal, regional, national or European levels. A more detailed analysis of the data may also reveal interesting reference indicators for urban sustainability that can help identify key factors in sustainable urban development.

8.4 Challenges of refugee migration into Europe for urban sustainability

The data in this study revealed that the most recent (2015) influx of refugees into Europe was mainly focused on cities with the highest sustainability performance scores. These cities are likely to provide good opportunities for people looking for a better future and may also be best equipped to guide refugees in establishing their new lives. However, not all cities that scored high on sustainability were found to be “resettlement cities.”

8.5 Recommendations for a research agenda to improve urban sustainability in all regions of the EU

The outcomes of this study point towards the need for developing a knowledge-generating program that can improve the responses to major urban sustainability challenges currently on the EU Urban Agenda. A key challenge for the Urban Agenda is finding answers and action perspectives on various issues, including:

1. How sustainable is the growth of cities that currently have a high level of wealth but are confronted with an aging population?
2. How can different types of shrinking cities be made sustainable again in the longer term?

3. Which urban zones are of decisive importance for improving sustainability performance in the EU, and how important are the interlinkages and mutual socioeconomic spin-offs in these regions?
4. How can smaller cities and towns be included in EU databases and policy instruments in order to obtain a more representative impression of the living conditions and developmental perspectives of the EU population as a whole? This would require a stimulation program that systematically collects and assembles sustainability data on larger and smaller cities as well as towns in the EU.
5. How can sustainability perspectives of smaller cities in Europe, in which the largest part of the EU population lives, be improved in the longer term without negatively impacting on their ecological and social quality?

These questions form the basis of an important urban sustainability research agenda. An explanatory model for sustainability performance should be designed to assist in finding answers to these types of questions. This study has already revealed the important building blocks of such a model, including the reference stocks and indicators that may play a crucial role in such a model. It is recommended that a European Knowledge Program on Improving Urban Sustainability be initiated in the framework of the Urban Agenda, building on URBACT and other EU initiatives.

Furthermore, this study has identified a number of improvements needed in data collection and handling. In general, it is recommended that data be collected at the city level for all indicators listed in Annex 2, although sustainability processes often have effects at a larger urban scale than the juridical city limits used here. Cities are the political building blocks for modelling such processes. More specifically, the following recommendations are made:

1. Expand the number of European cities included in the Urban Audit Perception Survey from the present 79 to at least 250, covering different sizes and all regions of the EU. This will allow more insight into the problems facing smaller European cities and a more accurate benchmarking of European cities and towns.
2. Data that covers the elements of the present migration crisis in Europe should be better monitored and shared in international data files, such as the location and size of refugee and asylum seeker centers, the mobility of migrants, and the cities in which they are being resettled after obtaining a residence permit.
3. Data that are related to economic indicators are often only available at NUTS 2 or higher aggregation levels, which makes it difficult to monitor the economic assets of cities. It is recommended that such data also be collected and shared at city level.
4. Although climate change is an international top priority in policymaking and must be realized by municipal initiatives of citizens and businesses, simple data on municipal CO2 reductions, realized and planned, are scarce. In our study, we relied on data available on the website of the Covenant of Mayors

on Climate and Energy,[27] which provides a good starting point but is far from complete. To obtain concrete and realistic feedback on actual EU and national policies in this sector, a monitoring system not only designed to fulfill the requirements of the UNFCCC but also to support actions at the municipal level is recommended.

5. Furthermore, it is recommended that more specific municipal data be collected on, for example, the state of technological advances in relation to energy transition (energy consumption by households, wind power, solar power, etc.), the transition to a circular economy and the availability of sustainable business areas.

[27] http://www.covenantofmayors.eu/

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Annex 1: Sustainability stocks and their requirements

Capital/ Stock	Requirements
Ecological capital	
Nature and landscape	Area covered by linked nature reserves. Preservation of biodiversity.
Soil and groundwater	Soil and groundwater are clean (for humans and wildlife). Preservation of the productive soil quality (for agriculture). No more water extraction than can be naturally replenished.
Drinking water and sanitation	Every household is connected to a public water supply and a sewer system with at least secondary treatment.
Air	Clean (for humans and wildlife). No adverse influencing of the climate.
Energy and climate	Cities show fast progress in a transition towards a zero carbon emission society.
Surface water	There is sufficient surface water and it is clean (for humans and wildlife).
Resources and waste	The extraction of non-renewable minerals is reduced.
Annoyance and emergencies	No unacceptable nuisance from odor, noise and dust. No unacceptable risk of calamities.
Social and cultural capital	
Social participation	There is social cohesion. There is no poverty or exclusion.
Political participation	Citizens are involved in politics (both passively and actively) and have access to the necessary information.
Economic participation	Everybody is able to afford essential requirements for life such as food, clothing and housing.
Health	The population is and perceives itself to be physically and spiritually healthy. Health care of good quality is accessible to everyone.

Education	Education meets the needs of society, is of high quality and easily accessible to all.
Residential environment	People are satisfied with their own home and living conditions, public facilities and everyday necessities are accessible and within easy reach.
Safety	Everyone feels safe in the city because the risk of becoming a victim of crime or accident is negligible.
Arts and culture	There is a wide diversity of culture on offer, accessible to anyone who wishes to make use of it either actively or passively. The cultural heritage is protected and strengthened.
Economic capital	
Labor	There is balance on the labor market (in both qualitative and quantitative terms). The workforce is well trained. Work is healthy.
Infrastructure and mobility	Rail and road infrastructure provides fast and nearby possibilities for transport. The accessibility (via road, water, rail, air, and ICT) of companies, facilities and economic centers is good.
Knowledge	The innovative and creative capability of companies, organizations and people is constantly being strengthened. The knowledge institutions play an active, supportive role in this.
Competitiveness	The economic structure has a good mix of driving industries and service industries. They are constantly regenerated by the arrival of new enterprises (starter companies and enterprises newly locating to the area).

Annex 2: Indicator definitions and the sources of their data

Indicator	Definition	Year	Level	Source
1. Concentration PM10	Average yearly PM10 concentration within city limits in µg/m3	2012	City	EEA, Interpolated air quality data
2. Concentration PM2.5	Average yearly PM2.5 concentration within city limits in µg/m3	2012	City	EEA, Interpolated air quality data
3. Emission of ammonia	Total NH3 emissions in kg / km2 year	2000	City	The European Nitrogen Assessment
4. Emission of nitrogen oxides	Total NOx emissions in kg / km2 year	2000	City	The European Nitrogen Assessment
5. Exposure to ozone	Sum of ozone means over 35 ppb	2012	City	EEA, Interpolated air quality data
6. Perception of air quality	Percentage of people that indicated that they are satisfied with the air quality in the city	2012	City	Eurostat, Perception Survey/WOON-enquête
7. Public water supply	Total water supply of a city in m3 per capita	2010	Regions	Eurostat
8. Waste water collected	Percentage waste water collected of total produced	2012	City	EEA, WISE Database
9. Waste water treated	Percentage of people connected to secondary or better waste water treatment	2012	City	EEA, WISE Database
10. Water consumption households	Total water consumption contributed to households in liter/day per capita	2010	River Basin Districts	Eurostat
11. CO2 Emissions	Greenhouse gas emissions in CO2 equivalents, in tons per capita	Various years (2008-2014)	City	Various (Local) Sources
12. CO2 Reduction realized	Realized CO2 reduction in the city between 1990 and 2010	2010	City	Various (Local) Sources
13. CO2 Reduction target	Target CO2 reduction in the city from 2010 and 2020	Various years	City	Various (Local) Sources
14. Agricultural area	Percentage of total area used for agricultural purposes	2006	City	EEA, Corine 2006 Database
15. Natura 2000 area	Percentage of total area indicated as protected Natura 2000 area	2000	City	EEA, Natura 2000 Database
16. Quality of nature	Percentage of the Natura 2000 area with a Good or Excellent quality status	2000	Natura 2000 area	EEA, Natura 2000 Database
17. Urban blue area	Percentage of area that is covered by water bodies and wetlands	2006	City	EEA, Corine 2006 Database
18. Urban green area	Percentage of area that is covered by forest and semi-natural areas	2006	City	EEA, Corine 2006 Database
19. Urban red area	Percentage of area that is covered by artificial area	2006	City	EEA, Corine 2006 Database
20. Airport noise	Percentage of population exposed to noise above 55 dB from airports	2013	City	EEA, Noise map
21. Perception of noise level	Percentage of population that indicated satisfaction with noise levels in the city	2012	City	Eurostat, Perception Survey/WOON-enquête
22. Rail noise >65dB	Percentage of population exposed to noise above 65 dB from railroads	2013	City	EEA, Noise map

23. Rail noise >55dB	Percentage of population exposed to noise above 55 dB from railroads	2013	City	EEA, Noise map
24. Road noise >55dB	Percentage of population exposed to noise above 55 dB from roads	2013	City	EEA, Noise map
25. Road noise >65dB	Percentage of population exposed to noise above 65 dB from roads	2013	City	EEA, Noise map
26. Incineration	Percentage of total waste collected that is processed by incineration	2013	City/NUTS 2/ National	EEA/CBS
27. Landfilling	Percentage of total waste collected that is processed by landfilling	Various Years (2009-2014)	Nuts 2/ National	EEA/CBS
28. Municipal waste	Municipal solid waste, in kg per capita	2010-2013	City/ Nuts 2	Eurostat
29. Chemical status ground water	Percentage of water bodies that have a good chemical status of groundwater	2012	River Basin Districts	EEA, WISE Database
30. Nitrogen surplus	Soil system nitrogen surplus for agricultural soils	2002	City	The European Nitrogen Assessment
31. Chemical status surface water	Percentage of water bodies that have a good chemical status of surface water	2012	River Basin Districts	EEA, WISE Database
32. Ecological status surface water	Percentage of water bodies that have a good or high ecological status of surface water	2012	River Basin Districts	EEA, WISE Database
33. Flood risk due to rainfall	Change in annual mean number of days with extreme precipitation (> 20 mm/day) for 2071-2100	2012	City	EEA, Potential flood risk
34. Soil sealing	Soil sealing (paved area) as a percentage of total area	2010	City	EEA, European Soil Sealing V2
35. Birth of businesses	Birth of businesses as a percentage of total active businesses	2010	Nuts 3/National	Eurostat
36. Death of businesses	Death of businesses as a percentage of total active businesses	2009	Nuts 3/National	Eurostat
37. Disposable income	Average disposable income per household	2011	Nuts 2	Eurostat
38. Employment growth	Growth in employment rate over the past 5 years	2010-2014	Nuts 2	Eurostat
39. Labor productivity	GDP in PPS per employees	2010	Nuts 2	Eurostat
40. Broadband connections	Percentage of households with access to a broadband connection	2014	Nuts 2/Nuts 1	Eurostat
41. Congestion motorways	Kilometer motorway per registered car	Various years (2009-2013)	Nuts 2	Eurostat
42. Cycle lanes	Length of cycle lanes per capita	Various years (2009-2013)	City/Nuts 2	Eurostat/Fietsersbond
43. Distance to airport	Distance to closest major airport	2015	City	Travelmath
44. Registered cars	Total cars registered per capita	Various years (2009-2014)	City	Eurostat
45. Satisfaction public transport	Percentage of people that indicated satisfaction with the public transport in the city	2012	City	Eurostat, Perception survey/WOON-enquête
46. Employment creative sector	Percentage of employment in the creative class	2008	Nuts 2	ESPON
47. Employment high-tech sectors	Percentage of active population employed in science and technology	2007	Nuts 2	ESPON

48. R&D expenditure	Percentage of GDP invested in research and development	Various years (2011-2014)	Nuts 2	Eurostat
49. Tertiary education	Percentage of active population with at least a tertiary education	2014	Nuts 2	Eurostat
50. Aging labor force	Percentage of the labor force older than 55	2014	Nuts 2	Eurostat
51. Employment function	Number of people employed divided by total number of jobs within the city	Various years (2010-2014)	City/Nuts 2	Eurostat
52. Employment rate	Total employment divided by the potential labor force	2014	City/Nuts 2	Eurostat
53. Unemployment rate	Percentage of the labor force which is unemployed	Various years (2008-2011)	City/Nuts 2	Eurostat
54. Museum visitors	Museum visitors per capita	Various years (2007-2013)	City/Nuts 2	Eurostat/Museum vereniging
55. Public libraries	Number of public libraries per capita	Various years (2005-2014)	City/Nuts 2	Eurostat/Openbare-bibliotheek.nl
56. Satisfaction cultural facilities	Percentage of people that indicated satisfaction with the cultural facilities in the city	2012	City	Eurostat, Perception Survey
57. Theaters	Number of theaters per capita	Various years (2007-2015)	City/Nuts 2	Eurostat/EM-Cultuur
58. Tourist overnight stays	Total nights spent in hotels per capita	Various years (2012-2014)	City/Nuts 2	Eurostat
59. Long-term unemployment	Percentage of labor force that is unemployed for over 12 months	2014	Nuts 2	Eurostat
60. Poverty rate	Percentage of people with a disposable income below the poverty threshold	Various years (2009-2013)	Nuts 2/Nuts 1	Eurostat
61. Satisfaction schools	Percentage of people that indicated satisfaction with schools and other educational facilities	2012	City	Eurostat, Perception survey/WOON-enquête
62. School dropouts	Percentage of students who leave education without a diploma	2014	Nuts 2	Eurostat
63. Secondary education	Percentage of population age 25-64 with at least a secondary education	2014	Nuts 2	Eurostat
64. Youth unemployment	Percentage of the labor force (age 15-24) that is neither working nor in education	2014	Nuts 2	Eurostat
65. General practitioners	Doctors and physicians per capita	Various years (2009-2014)	Nuts 2/Nuts 1	Eurostat
66. Hospital beds	Hospital beds per capita	Various years (2009-2014)	Nuts 2/ Nuts 1/ National	Eurostat/CBS
67. Infant mortality rate	Total deaths per 1000 live births	Various years (2011-2014)	City	Eurostat
68. Life expectancy	Life expectancy at birth, in years	Various years (2012-2013)	Nuts 2	Eurostat
69. Satisfaction hospitals	Percentage of people that indicated satisfaction with health care services, doctors and hospitals	2012	City	Eurostat
70. European elections turnout	Turnout on most recent elections for European parliament	2014	City/ Nuts 2/ National	Eurostat/ EED-NSD/ Various (Local) Sources
71. Municipal elections turnout	Turnout on most recent elections for municipal council	Latest local election	City/national	Various (Local) Sources

72. National elections turnout	Turnout on most recent elections for national parliament	Latest local election	City/national	Eurostat/ EED-NSD/ Various (Local) Sources
73. Political trust	Percentage of people that indicated trust in the public administration of the city	2012	City	Eurostat, Perception Survey
74. Migration	Average annual net migration per 1,000 inhabitants	2013	Nuts 3	Eurostat
75. Rental price	Average annual rent for housing per m² - EUR	2015	City	Expatistan, Cost of Living Index
76. Satisfaction housing	Percentage of people that indicated it is easy to find good housing at a reasonable price in the city	2012	City	Eurostat, Perception Survey
77. Satisfaction living in city	Percentage of people that indicated satisfaction with living in the city	2012	City	Eurostat, Perception Survey/WOON-enquête
78. Satisfaction sports facilities	Percentage of people that indicated satisfaction with sports facilities in the city	2012	City	Eurostat, Perception Survey
79. Burglaries	Burglaries per capita	2010	Nuts 3	Eurostat
80. Intentional homicides	Intentional homicides per capita	2010	Nuts 3	Eurostat/CBS
81. Perception of safety	Percentage of people that indicated they feel safe in the city	2012	City/ Dutch Safety-Area	Eurostat, Perception Survey/WOON-enquête
82. Robberies	Robberies per capita	2010	Nuts 3	Eurostat
83. Traffic fatalities	Traffic fatalities per capita	Various years (2008-2013)	City	Eurostat
84. Perception of foreigners	Percentage of people that indicated the presence of foreigners is good for the city	2012	City	Eurostat, Perception Survey
85. Trust in people	Percentage of people that indicated most people in the city can be trusted	2012	City	Eurostat, Perception Survey

Annex 3: Indicators with approximations

Indicator	Remark
Public water supply consumption; Household consumption	Data was collected from Eurostat and from local sources. Examples of sources used include city statistical offices and city policy documents. As different sources were used, it is possible that the definition of data varies. For Innsbruck, Kortrijk, Vidin, Brno, Karlovy Vary, Karviná, Olomouc, Narva, Arras, Belfort, Tours, Magdeburg, Athens, Thessaloniki, Szombathely, Naples, Jelgava, Klaipėda, Białystok, Łódź, Ostrów Wielkopolski, Pitești, Trenčín, Glasgow and Stoke-on-Trent, nationwide data were used for public water supply consumption. For Kortrijk, Sofia, Vidin, Yambol, Brno, Karlovy Vary, Karviná, Olomouc, Narva, Tallinn, Oulu, Arras, Belfort, Athens, Miskolc, Szombathely, Jelgava, Klaipėda, Vilnius, Ostrów Wielkopolski, Braga, Porto, Valongo, Viseu, Constanta, Piatra Neamț, Málaga, Brighton and Hove, Manchester, Newcastle and Stoke-On-Trent, nationwide data were used for household consumption.
CO2 Emissions; CO2 reductions realized; CO2 reduction target	There is no source that provides data for these emissions on a regional level for all European regions. Therefore we had to collect data from local sources for these indicators. Examples of sources used include city statistical offices and city policy documents. The website of the Covenant of Mayors was also used, as well as data from the Entracte Project.
Landfilling; Incineration	Data was collected mainly from the EEA and the CBS. Missing data from those sources were collected from local sources. Examples of sources used included city statistical offices and city policy documents. Data was not always available on city level and, therefore, sometimes NUTS 2 or national data was used.
Road, Rail and Airport Noise	Data for these indicators was not available on a city level for all cities. For those cities without data, the numbers are based on the average of the data available for other cities in the same country. No numbers were available for Greece, therefore, an approximation of the average value from cities of neighboring countries was used.
Perception of air quality; Perception of noise level; Satisfaction public transport; Satisfaction cultural facilities; Satisfaction schools; Satisfaction hospitals; Political trust; Satisfaction housing; Satisfaction living in city; Satisfaction sports facilities; Perception of safety; Perception of foreigners; Trust in people	Data for these indicators were taken from the Eurostat perception survey. Unfortunately, not all cities in our sample were included in this survey. In such cases, data from neighboring cities with a similar typology were used: For Ghent we used Antwerp For Bremen we used Hamburg For Magdeburg we used Leipzig For Hannover we used Berlin For Freiburg and Frankfurt we used Kaiserslautern For Munster we used Dortmund For Thessaloniki we used Athens For Larissa we used Iraklion For Seville and Murcia we used Málaga For Santander, Vitoria-Gasteiz and Pamplona we used Oviedo For Zaragoza and Valencia we used Madrid For Nantes we used Rennes For Tours and Arras we used Lille For Reggio Emilia and Florence we used Bologna For Kaunas and Klaipėda we used Vilnius For Nijmegen we used Groningen For Braşov we used Piatra Neamț

	For Pitești and Constanta we used Bucharest For Espoo and Tampere we used Oulu For Bristol and Brighton and Hove we used London For Stoke-on-Trent we used Manchester For Łódź and Ostrów Wielkopolski we used Kraków For Bydgoszcz and Toruń we used Gdansk For Umeå we used Malmö For Innsbruck we used Graz For Kortrijk we used Brussels For Vidin we used Sofia For Yambol we used Burgas For Brno, Karviná and Olomouc we used Ostrava For Karlovy Vary we used Prague For Narva we used Tallinn For Belfort we used Strasbourg For Toulon we used Marseille For Szombathely we used Budapest For Galway, Limerick and Waterford we used Dublin For Milan we used Turin For Jelgava we used Riga For Viseu, Porto and Valongo we used Braga For Trenčín we used Bratislava For Prešov we used Košice For Linköping we used Stockholm For Nuremberg we used Munich For Lelystad we used Amsterdam For Middelburg and The Hague we used Rotterdam For the Dutch 100,000+ cities, an approximation was made based on the average of all the Dutch cities covered by the Perception Survey. For "Perception of air quality," "Perception of noise level," "Satisfaction schools," "Satisfaction public transport," "Perception of safety" and "Satisfaction living in the city," data from the Woonenquête was used.
Employment rate; Unemployment rate; Employment function	For these indicators, we used city-level data. In a few cases, city-level data was not available. In those circumstances we used NUTS 2 data.
At-risk-of-poverty rate	For Belgium, Estonia, Tampere (Finland), Greece, Hungary, Luxembourg, Malta, Poland, Portugal and the United Kingdom, no data on the NUTS 2 level was found. For cities in those countries, NUTS 1 data was used.
European elections turnout	For Athens, Florence, Milan, Naples, Braga, Valongo and all cities in Poland, national data was used. For Kaunas, Klaipėda, Vilnius, Viseu, Brighton and Hove and Bristol, NUTS 1 data was used.
Municipal elections turnout	No city-level data was found for the cities in Lithuania. For these cities, the national average turnout for the same elections was used.
National elections turnout	No city-level data was found for Vidin, Yambol, Brno, Karlovy Vary, Karviná, Olomouc, Narva, Ostrów Wielkopolski, Bucharest, Constanta, Piatra Neamț or Prešov. For these cities, the national average turnout for the same elections was used.
	Data for the Dutch cities was not available. Therefore, the data from Statistics Netherlands was used. This data was, however, on NUTS 2 level.
Museum visitors; Theaters; Public libraries	No city-level data was found for the Dutch cities. For the Dutch cities in the sample and the Dutch 100,000+ cities, NUTS 2 data was used.
Tourist overnight stays	For Ireland, the Netherlands and the United Kingdom we used NUTS 2 data.

Broadband connection	NUTS 2 data was not available for every region. For the cities in Germany, Greece, Poland and the United Kingdom, NUTS 1 data was used.
Infant mortality rate; Employment rate; Unemployment rate; Registered cars	Westland and Emmen, from the Dutch 100,000+ cities, are not represented in Eurostat's Urban Audit sample. For these indicators, we used the data from Zoetermeer for Westland, and the data from Almelo for Emmen.
General Practioners	No NUTS 2 data was found for Germany. For the German cities, NUTS 1 data was used.
Start-up and Close-down of Businesses	Data for these indicators was not always available from Eurostat. For the cities in Belgium, Germany, Ireland, the United Kingdom, Lithuania, Latvia, Luxembourg, Malta and Sweden national data was used.

Annex 4: Sustainability rating of EU cities arranged from highest to lowest total scores

City	Total score	Ecological score	Socio-cultural score	Economic score
Espoo	65.0	63.5	66.5	65.0
Copenhagen	63.9	62.8	62.7	66.0
Stockholm	63.8	60.8	67.0	63.7
Munich	63.6	61.6	67.7	61.5
Helsinki	63.2	58.7	64.7	66.0
Luxembourg	62.9	54.5	70.3	64.1
Linköping	62.9	65.6	63.8	59.3
Umeå	61.9	70.6	61.9	53.1
Tampere	61.8	66.9	65.2	53.4
Nuremberg	61.6	61.5	64.1	59.3
Innsbruck	60.9	58.6	62.3	61.6
Hamburg	59.3	60.6	57.0	60.3
Oulu	58.9	64.4	61.7	50.6
Frankfurt	58.5	59.8	57.2	58.6
Vienna	58.4	58.6	56.0	60.5
Freiburg	58.3	62.3	58.6	54.1
Amsterdam	58.1	58.0	55.4	61.0
Nijmegen	57.6	57.5	57.5	57.8
Malmö	57.3	61.0	56.7	54.2
Munster	57.1	61.7	57.4	52.2
Ljubljana	56.6	54.4	58.9	56.4
Bremen	56.0	60.6	51.7	55.7
The Hague	55.9	60.0	52.3	55.4
Prague	54.9	47.9	57.2	59.6
Lelystad	54.8	61.8	49.3	53.2
Nantes	54.7	56.0	55.2	52.7
Rennes	54.6	52.7	56.7	54.3
Hannover	54.2	59.5	51.4	51.6
Berlin	54.2	60.2	48.8	53.4
Bratislava	54.1	56.6	50.0	55.7
Rotterdam	53.9	57.5	48.6	55.6
Bordeaux	53.7	55.6	52.7	52.9
Essen	53.7	57.1	54.1	49.8
Middelburg	53.6	55.2	56.0	49.7

Antwerp	53.6	51.2	54.8	54.7
Waterford	53.4	53.9	50.9	55.5
London	53.3	49.0	49.4	61.5
Ghent	52.8	47.0	56.9	54.3
Bristol	52.8	53.2	49.0	56.2
Tours	52.6	54.7	49.8	53.2
Brighton and Hove	52.3	53.6	51.2	52.1
Limerick	52.2	54.4	49.2	53.0
Dublin	52.2	50.2	52.1	54.3
Magdeburg	52.1	60.7	50.0	45.6
Belfort	51.9	52.2	51.5	52.0
Vitoria-Gasteiz	51.8	50.9	53.9	50.8
Tallinn	51.6	60.6	46.3	47.9
Brno	51.5	50.8	52.6	51.2
Paris	51.4	43.5	51.0	59.8
Brussels	51.1	57.1	44.0	52.0
Kortrijk	50.7	44.6	54.7	52.7
Glasgow	50.7	51.5	52.3	48.2
Newcastle	50.5	51.7	53.7	46.0
Toulon	50.4	58.3	42.1	50.9
Madrid	50.2	53.4	43.7	53.5
Pamplona	49.9	45.8	53.6	50.2
Warsaw	49.7	46.7	49.1	53.2
Galway	49.5	55.6	45.9	47.1
Budapest	49.4	50.9	49.3	48.1
Vilnius	49.2	59.2	42.8	45.5
Manchester	49.0	48.5	50.1	48.3
Szombathely	48.2	56.8	47.4	40.2
Barcelona	48.2	50.0	45.3	49.3
Marseille	48.1	54.9	39.1	50.3
Florance	48.0	45.1	51.1	47.7
Kaunas	47.9	58.0	43.7	42.1
Valletta	47.9	39.1	52.8	51.7
Sofia	47.7	55.4	39.3	48.4
Narva	47.5	61.6	40.4	40.6
Arras	47.4	46.2	44.6	51.3
Klaipėda	47.4	57.7	42.5	41.8
Murcia	47.4	57.6	44.2	40.4
Lille	47.3	46.1	43.4	52.4
Cluj-Napoca	47.3	56.0	47.7	38.2

Olomouc	47.2	49.0	50.3	42.3
Stoke-on-Trent	46.9	48.7	48.4	43.7
Lisbon	46.8	48.5	44.2	47.7
Santander	46.6	43.6	50.6	45.5
Riga	46.5	56.1	38.6	44.8
Reggio Emilia	46.2	41.1	49.2	48.1
Zaragoza	46.0	54.8	40.8	42.5
Porto	45.9	49.7	47.9	40.1
Karlovy Vary	45.9	52.7	45.2	39.9
Seville	45.9	50.1	43.3	44.2
Viseu	45.9	59.6	45.6	32.5
Milan	45.7	40.8	46.8	49.4
Bucharest	45.7	46.8	43.3	46.8
Kraków	45.6	43.1	50.2	43.5
Toruń	45.4	49.4	48.8	37.9
Turin	45.2	45.7	43.8	46.1
Piatra Neamț	45.1	62.4	44.6	28.3
Karviná	45.0	49.8	45.2	40.1
Valencia	44.8	50.2	39.7	44.4
Jelgava	44.6	57.7	33.7	42.3
Bydgoszcz	44.6	48.1	45.9	39.8
Ostrów Wielkopolski	44.3	44.0	45.2	43.7
Málaga	44.1	50.0	41.4	40.8
Prešov	44.0	53.0	42.2	36.9
Braga	44.0	52.3	43.7	36.0
Brașov	44.0	58.1	44.5	29.3
Białystok	43.8	47.0	47.9	36.6
Valongo	43.7	46.8	44.0	40.1
Trenčín	43.1	52.9	40.8	35.6
Miskolc	42.3	55.9	37.7	33.3
Pitești	41.7	61.4	35.2	28.5
Łódź	41.4	39.7	45.5	39.1
Rome	41.3	41.7	36.8	45.3
Yambol	41.3	51.7	39.6	32.5
Larissa	39.1	49.1	38.4	29.9
Athens	39.0	37.5	33.3	46.0
Vidin	38.0	50.8	34.4	28.8
Constanța	37.4	52.1	33.4	26.7
Thessaloniki	35.1	41.0	31.3	32.8
Naples	35.0	36.3	33.1	35.5

Annex 5: Comparing 31 Dutch and 20 similarly sized and located EU cities on total and capital scores

City	Total score	Ecological score	Socio-cultural score	Economic score
Linköping	62.9	65.6	63.8	59.3
Umeå	61.9	70.6	61.9	53.1
Nuremberg	61.6	61.5	64.1	59.3
Apeldoorn	59.5	61.6	59.6	57.3
Amersfoort	59.5	56.9	59.1	62.5
Haarlem	59.1	59.6	59.2	58.4
Utrecht	59.0	56.3	57.4	63.4
Haarlemmermeer	58.9	54.4	58.4	64.0
Ede	58.5	60.9	59.6	54.9
Frankfurt	58.5	59.8	57.3	58.6
Freiburg	58.3	62.3	58.6	54.1
Zaanstad	58.2	59.8	58.0	56.8
Amsterdam	58.1	58.0	55.4	61.0
Groningen	57.7	57.4	59.4	56.2
Nijmegen	57.6	57.5	57.5	57.8
Zwolle	57.5	60.2	57.7	54.5
Malmö	57.3	61.0	56.8	54.2
Dordrecht	57.2	62.6	55.5	53.4
Munster	57.1	61.7	57.4	52.2
Emmen	56.4	60.3	57.6	51.2
Almere	56.4	63.7	51.4	54.0
Arnhem	56.2	55.4	56.8	56.5
Alphen aan den Rijn	56.1	59.2	54.0	55.0
Bremen	56.0	60.6	51.7	55.7
The Hague	55.9	60.0	52.3	55.4
Alkmaar	55.8	51.0	58.1	58.5
Zoetermeer	55.8	59.8	50.8	56.8
's-Hertogenbosch	55.7	51.9	55.6	59.6
Venlo	55.5	55.9	55.6	54.9
Delft	55.5	55.3	55.1	56.0
Tilburg	55.4	52.5	55.9	57.9
Leiden	55.4	54.1	55.3	56.7
Maastricht	54.8	57.5	54.2	52.9
Breda	54.8	51.9	54.1	58.3

Lelystad	54.8	61.8	49.3	53.2
Leeuwarden	54.3	57.9	54.0	51.1
Enschede	54.3	56.7	54.3	51.9
Hannover	54.2	59.5	51.4	51.6
Eindhoven	54.1	47.4	53.7	61.2
Westland	54.1	55.7	54.7	52.0
Rotterdam	53.9	57.5	48.6	55.6
Essen	53.7	57.1	54.1	49.8
Middelburg	53.6	55.2	56.0	49.7
Antwerp	53.6	51.2	54.8	54.7
Ghent	52.8	47.0	56.9	54.3
Bristol	52.8	53.2	49.0	56.2
Brighton and Hove	52.3	53.6	51.2	52.1
Magdeburg	52.1	60.7	50.0	45.6
Belfort	51.9	52.2	51.5	52.0
Kortrijk	50.7	44.6	54.7	52.7
Glasgow	50.7	51.5	52.3	48.2
Newcastle	50.5	51.7	53.7	46.0
Stoke-on-Trent	46.9	48.7	48.4	43.7

Annex 6: Letter of 26 June 2015 from the Dutch Minister of the Interior and Kingdom Relations to the House of Representatives on the objectives of the Dutch EU Presidency for the EU Urban Agenda

In the letter from the Cabinet dated 28 January 2015 concerning the preparations of the contents of the agenda for the Dutch EU presidency[28], the House was informed about the points of departure and proposed initiatives during the Dutch presidency. The Netherlands will be aiming for a Union that focuses on the essentials, creates growth and jobs through innovation, seeks engagement in European societies, and connects with citizens[29].

During its presidency, the Netherlands will also be focusing attention on urban issues. Cities are the powerhouses for economic growth, breeding grounds for innovation, and essential actors in attaining the EU 2020 targets. The Netherlands – together with the European Commission[30] - is of the opinion that the economic and social potential of European cities can and must be better utilized. With that in mind, the Netherlands will be working on establishing a more 'urban proof' EU, by contributing to the development of an EU Urban Agenda.

The objective of the EU Urban Agenda is an improved working method at EU level and greater coherence between the European institutions and better coordination within the European Commission. The aim is to reduce and improve EU legislation that unnecessarily restricts urban development (Better Regulation), to improve access to and utilization of European funds and encouraging the sharing of knowledge and best practices on innovative solutions for the challenges facing Europe's cities. During the presidency, an international podium will also be provided for Dutch urban innovations, via the Innovation Conference 2016, 'Cities of the future'.

The House has also been sent the reaction of the Cabinet[31] to the consultation[32] by the European Commission on the urban dimension in EU policy. In this reaction the Dutch goals for the EU Urban Agenda are laid down in general. The EU Urban Agenda will serve to further investigate those areas in which the urban dimension is still insufficiently present in EU policy. It will also explore how the urban dimension can better be anchored in EU policy and how cooperation between cities, Member States and the European Commission and the other institutions can be further boosted.

During the technical briefing concerning the BNC document relating to the EU Urban Agenda[33] on 5 February 2015, your House requested further information about the elaboration of the EU Urban Agenda. By means of this letter, I am providing you with that information.

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[28] Cabinet letter reference 34139, A
[29] Cabinet letter reference 34 139, A
[30] Cabinet letter reference 34 139, A
[31] Cabinet letter reference 22112, no. 1918
[32] COM (2014) 490
[33] Cabinet letter reference 22112, no. 1934

In this letter I will explain the importance of cities for growth and jobs, the intended contribution by the EU Urban Agenda to improved EU policy, and inform you about the progress in the preparations for the EU Urban Agenda.
The House will simultaneously be informed in another letter about the progress of the Dutch (national) Urban Agenda. In the proposed National Budget for 2015 and the letter about Working on Growth, the Cabinet announced its intention to send a national Urban Agenda to the House of Representatives, containing measures for strengthening growth, livability and innovation in Dutch cities[34]. Both letters outline how the two letters complement one another.

1. The importance of cities for growth and jobs

Cities are powerhouses for the economy
Cities are powerhouses for economic growth, breeding grounds for innovation and commercial activity, and sources of new employment and job growth. International and national research[35] [36] indicates that cities are becoming increasingly important for economic growth. Even today, approx. 67% of the GDP of Europe is generated in urban areas.[37] A number of Dutch cities and urban regions are listed high on international rankings for competitiveness, innovation and quality of life. Looking to the future, due to increasing global dynamism and economic uncertainties, the relatively favorable position of the majority of Dutch cities no longer remains self-evident. The same also applies to many other European cities.

Social challenges come together in cities
More and more people are living in cities; in Europe, approximately 72% of the population are city dwellers. The urban population is due to increase, and is expected to reach more than 80% in Europe, by 2050.[38]11 The quality of life of people will as a consequence be increasingly determined by the development of the urban surroundings over the next few decades. Cities are faced by huge social challenges in respect of transport, housing, employment, energy, climate and social cohesion, among others. Cities are therefore key players in achieving the Europe 2020 objectives.

Removing obstacles to growth, innovation and livability
The power of cities is to a large extent determined by the residents, industry, knowledge institutions and social organizations. Government can establish the necessary conditions for promoting growth, innovation and livability, for example by removing obstacles and creating opportunities. In a Dutch context, with this in mind, the Cabinet has established collaboration with cities and other stakeholders in the Dutch Urban Agenda.

We are implementing the European urban dialogue

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[34] Cabinet letter reference 34000, no. 1 and Cabinet letter reference 34000, no. 4
[35] OECD Territorial review of the Netherlands (2014)
[36] PBL/CPB 2015
[37] COM(2014) 490
[38] COM(2014) 490

The EU Urban Agenda ties in with the dialogue initiated by the European Commission with Member States and cities concerning the urban future for Europe. The report Cities of Tomorrow describes the challenges facing Europe's cities, together with a vision on the development of smart, sustainable and socially-inclusive cities, and good examples of urban development and measures for strengthening the position of the European urban network.[39]

2. Contribution by the EU Urban Agenda to improved EU policy

Strengthening the competitiveness of cities
On a European scale, together with the European Commission and other European institutions, the Member States and cities, the Netherlands aims to contribute to a strengthening of the international competitiveness and quality life of Europe's cities via an EU Urban Agenda that ensures improved cooperation and improved embedding of the urban dimension in European policy.

Interaction between the Dutch Urban Agenda and EU Urban Agenda
The Dutch Urban Agenda and the EU Urban Agenda complement one another. Increasingly, urban issues are becoming transnational in nature and mutually comparable. The Dutch Urban Agenda can serve as an example for innovative cooperation for other Member States. Dutch cities can also learn from other European cities about how to deal with major social challenges. At the same time, EU legislation identified in the framework of the Dutch Urban Agenda that restrict Dutch cities and urban agglomerations in competitiveness and innovative capacity can be made part of the EU Urban Agenda, and as such be part of the dialogue aimed at improving EU policy.

An EU Urban Agenda: EU policy that takes cities into account
The EU Urban Agenda is a collaborative agenda between cities, Member States and European institutions. The EU Urban Agenda aims to make EU policy more 'Urban Proof', and to make sure that EU policy takes the impact on cities more into account. Making EU policy more 'Urban proof' means that cities can start to achieve their full growth potential in terms of growth and jobs, and make the maximum possible contribution to a sustainable, competitive and livable Europe[40] [41] [42] [43].

The cities themselves are indicating the need for this approach[44]. Cooperation and coordination between the various layers of government and policy sectors is still

[39] European Commission, Cities of Tomorrow (October 2011)
[40] Towards an Integrated Urban Agenda for the EU, CoR (2014)
[41] The urban dimension of EU Policies – key features of an EU Urban Agenda (September 2014)
[42] http://www.vng.nl/files/vng/pagina_attachments/2014/20140925-reactie-vng-g4-g32-consultatie-urban-agenda.pdf
[43] Committee of the Regions, rapporteur Verkerk, "Towards an integrated approach to cities in the European Union".
[44] http://kennisopenbaarbestuur.nl/rapporten-publicaties/europa-als-kans-better-regulation-voor-nederlandse-medeoverheden/ and also http://kennisopenbaarbestuur.nl/rapporten-publicaties/de-wisselwerking-tussen-europa-en-nederland/

insufficiently secured. In the development of EU policy the implementation aspects (including the implementation burdens) for cities, as well as the integrated nature of urban challenges, are not taken into account sufficiently. Greater cohesion is needed between the European institutions as well as improved coordination with the European Commission.

The EU Urban Agenda is not an agenda for new policy or new competences, but a working method for achieving real improvements in the instruments available to the EU, in line with the principles of subsidiarity and proportionality. The EU Urban Agenda will thereby focus on improved EU legislation for cities (‘Better Regulation’), improved access to and utilization of European funds for cities, and improved knowledge sharing and cooperation between cities.

Better Regulation
Cities and other local levels of government are important implementing bodies for European legislation and regulations. In many cases, European regulations are also essential in enabling local governments to achieve objectives within their own responsibility at local and regional level, for example in respect of a healthy (human) environment. The layout of public administration in the Member States is in fact not a competence of the European Union. This makes it difficult to precisely determine the effects of EU legislation in practice. In implementation and execution, this often leads to unexpected (administrative and financial) implementation burdens. Cities and other local levels of government suggest that EU policy does not always tie in well with an area-based approach at local and regional level.16 17. This is above all perceived in cities where the wide range of social challenges and European legislation come together.
It is possible to make improvements to the current European decision making process. The Dutch focus on Better Regulation in fact calls on specific attention for the effects of European legislation and regulations for cities and other local levels of government in that framework. This question must tie in with the possibilities and authorities of the individual European institutions. By focusing more attention on the effects of European legislation, the conditions will be created for better utilizing the potential of the cities. For that reason, consideration is for example being given to including the urban dimension in the impact assessments. The importance of Better Regulation is more broadly supported across Europe, as for example illustrated by the broadening of the REFIT program, and the allocation of the Better Regulation portfolio to the First Vice President of the European Commission.

Improved access to and utilization of EU funds and EU programs Cities indicate that it is important that greater attention be focused on the implementation and administrative burdens of EU funds and other financial EU programmes. Cities have for example indicated that it is difficult in practice to combine funds for area-specific, integrated solutions.18 In the framework of the EU Urban Agenda, further investigation will be undertaken into whether and if yes, which obstacles various European cities have experienced in practice in making use of European funds that are most relevant for cities, such as the ESF, ERDF, Horizon 2020 and LIFE.

18 Towards an Integrated Urban Agenda for the EU, CoR (2014)

Improved knowledge sharing and cooperation
At present, existing European data provide an incomplete picture of urban practice, and data that are available, are insufficiently utilized. In the information approach currently employed by Europe, use is made of a regional classification of European statistics (so-called NUTS levels), as a result of which cities and urban agglomerations are insufficiently represented in the data. How the relevant knowledge shortfalls in respect of urban agglomerations and urban practice at a European level can be removed will be part of the EU Urban Agenda.
Consideration will also be given to how knowledge sharing and cooperation can be further strengthened in realizing best practices in respect of the major common social challenges, making use of existing networks and platforms, such as EUKN, Urbact and Urban Community Initiatives.
The European Commission and the UN Human Settlements Program (UN HABITAT) will publish a joint study during the Dutch presidency concerning the State of European Cities. This study will also provide a contribution to the further development of the EU Urban Agenda.

Cooperation between cities, Member States and the European Commission
The EU Urban Agenda intends to bring about greater involvement by cities in EU policy and closer cooperation between cities, Member States and the European Commission in improving current EU policy. This cooperation is aimed at obtaining a clear insight into obstacles experienced by the various cities of differing sizes and population composition, and in different locations and facing different challenges in Europe.
The EU Urban Agenda is expected to initiate dialogue on the specific issues and challenges facing cities and on how an integrated policy or the removal of national and European obstacles can strengthen the capacity of the cities to solve the relevant social challenges. The cities are identifying issues for example relating to labor migration, urban poverty, social divisions, climate adaptation, renewable energy generation, an energy-neutral built environment and more sustainability in urban mobility. Obstacles to transnational cooperation, for example in the field of education and the labor market, are also often referred to.
The EU Urban Agenda is a rolling agenda. The concrete cases, which will be investigated in the framework of cooperation in the EU Urban Agenda for obstacles to opportunities for cities, will be inventoried together with the cities and Member States, and with involvement by the European Commission and other European institutions. A key criterion in that respect will be whether there are indications for obstacles in EU policy and/or the EU funds for cities, and whether there are opportunities for improved knowledge sharing and cooperation. Another criterion is whether the themes tie in with the EU2020 objectives and the Commission's priorities for growth and jobs. During the Dutch presidency, in the framework of the EU Urban Agenda, cooperation between cities, Member States and the European Commission to improve EU policy will be presented, in respect of a number of individual cases.

Support for the EU Urban Agenda

There is broad support for the EU Urban Agenda among European cities, the EU Member States and European institutions. As already indicated in the Cabinet reaction to the consultation by the European Commission on the urban dimension in EU policy, there is broad support from the (city associations) G4, G32, the Association of Netherlands Municipalities (VNG) and the Association of Provincial Authorities (IPO) for the EU Urban Agenda[45]. On 21 April 2015, Amsterdam also signed the Vienna Declaration, in which European capital cities express support for the EU Urban Agenda[46] and call for structural involvement by cities in the EU decision making process.

Within Europe, at various moments, support has been expressed for a EU Urban Agenda. There is broad support for a EU Urban Agenda among European cities. Representatives of cities and regions (Committee of the Regions[47], Eurocities[48] and CEMR[49]), have indicated the need for an urban agenda at a European level. The European Parliament in the past spoke out in favor of a EU Urban Agenda, and at the end of 2014 appointed a rapporteur who is expected to issue a recommendation on the issue around the summer of 2015. The European Commission recently issued a report based on the previously referred to consultation about the urban dimension in EU policy. In this report, the European Commission explained its vision on its role within and the internal workings of the EU Urban Agenda.[50] Member States, cities and the European Commission will start to implement mutual cooperation in the run-up to the Dutch presidency.

3. Progress in preparations for the EU Urban Agenda

Riga Declaration (10 June 2015)

The EU Member States are key partners in the development of the EU Urban Agenda. During the Italian presidency in 2014, council conclusions were adopted that encourage the Member States and the European Commission to develop a EU Urban Agenda.[51] The current EU president, Latvia, has also a contributed actively to the development of an EU Urban Agenda. During the informal Ministerial meeting on urban development in Riga on 10 June 2015, at the invitation of the current president, the Ministers reached agreement on working towards a joint EU Urban Agenda during the Dutch EU presidency in 2016.

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[45] http://www.vng.nl/files/vng/pagina_attachments/2014/20140925-reactie-vng-g4-g32-consultatie-urban-agenda.pdf

[46] Vienna Declaration by the Mayors of the EU Capital Cities - "A strong voice in Europe" (21 April 2015)

[47] Towards an Integrated Urban Agenda for the EU, CoR (2014)

[48] The urban dimension of EU Policies – key features of an EU Urban Agenda (September 2014)

[49] CEMR (Council of European Municipalities and Regions) First Contribution to an Urban Agenda, CEMR (2014)

[50] SWD(2015) 109 final/2

[51] Conclusions of the General Affairs Council (November 2014)

Ministerial meeting in Amsterdam (30 May 2016)
During the Dutch EU presidency, an EU Urban Agenda will be agreed upon by the Member States with support from cities and the European Commission. During the presidency, the Cabinet wishes to specifically involve important partners in the EU Urban Agenda, including Eurocities and the Committee of the Regions. In 2016, Amsterdam will also be organizing a summit meeting of mayors of European capital cities, aimed at supporting the EU Urban Agenda.

Podium for Dutch urban innovation (14 April 2016)
In the period of the EU presidency, innovative Dutch solutions for urban challenges will be given an international podium during an Innovation Conference. The Innovation Conference 2016 ‘Cities of the future’ consists of a network of more than 4,000 entrepreneurs, policy makers, academics and socially engaged citizens. Together they work on technological breakthroughs and innovations that could make a difference for cities in the future. During the Innovation Conference this network will be brought together. In the run-up to the event, innovations will be elicited and further encouraged.